

TECHNICAL MANUAL

OPERATION AND SERVICE MANUAL

**BATTERY POWERED
HEAT GUN ASSEMBLY**

PART#: MCH-100-A

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WARNING**HOT AIR TOOL CAN PRESENT A FIRE AND EXPLOSION HAZARD**

The hot air tool must be used in a ventilated area. The internal heating element and built in fan motor may present a hazard when exposed to certain flammable vapors associated with, for example, gasoline, methane, jet fuel and propane.

WARNING**HOT AIR TOOL IS SHIELDED FROM ELECTROMAGNETIC EMISSIONS AND ENVIRONMENTAL EFFECTS**

The hot air tool is manufactured to meet certain EMI requirements as specified by the US Military. Tampering with the electromagnetic (EMI) shield or not following repair instructions outlined in the technical manual, may affect the integrity of the EMI shield and result in radiated emissions coming from the tool above the approved limits.

WARNING**HIGH VOLTAGES ARE PRESENT IN THE OPERATION OF THIS EQUIPMENT**

Avoid contact with the DC and AC supply voltage connections during installation, operation or maintenance of the MCH-100-A and its battery charging system. Disconnect the batteries before opening the tool.

WARNING**NO SMOKING IS PERMITTED NEAR THE CHARGING STATION AND AIR TOOL**

Batteries can produce explosive gases during charging or discharge cycles. Never smoke or allow open flames near the charging station or the hot air tool while they are in use.

CAUTION**HOT AIR TOOL CAN CAUSE BURNS**

Every effort should be made to avoid contact with the hot air tool stainless steel heating element cover and nozzles during operation, because this part of the tool becomes very hot and can cause burns. Do not point the hot air flow in the direction of people or animals.

CAUTION**ACID CONTAMINATES NICKEL-METAL HYDRIDE BATTERIES**

Every effort must be made to keep Nickel-Metal Hydride batteries as far away as possible from lead acid batteries, because lead acid batteries contain sulfuric acid. Do not use the same tools and material, such as screwdrivers, wrenches, syringes, hydrometers and gloves for both types of batteries. Any trace of acid or acid fumes will permanently damage Nickel-Metal Hydride batteries on contact.

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Any questions regarding operation, maintenance, repairs, parts and accessories can be directed to Malcom Company through our toll free number from the USA at 800-289-7505 or from other parts of the world by calling 401-683-3199. We also have a web site at www.malcom.com where you can place orders and email us with questions at any time.

CHAPTER 1

Introduction



**Figure 1-1. Battery Powered Heat Gun Kit
MCH-100-A**

1-1. **SCOPE.**

1-1.1. The MCH-100-A Battery Powered Heat Gun Kit, manufactured by Malcom Technologies, is an intelligent, maneuverable, adaptable, and self-sufficient sustainment repair tool designed for field deployment or shop usage in applications such as contact-less soldering and de-soldering, heat shrink recovery, plastic welding, drying, deicing, and other hot air applications. Additional accessories can be attached for contact soldering, composite curing, and for applications requiring a custom design tool.

1-1.2. **The MCH-100-A Kit consists of:**

PN	QTY	Description	Figure
111.038.1	1	Battery Powered Heat Gun with a 300-watt element	Figure 1-2
MCH-102NW	1	48DCV Power Supply	Figure 1-3
BT-70790	2	24 volt NiMh Rechargeable Battery, BB-390 B/U	Figure 1-4
BTC-70819	1	Universal Battery Charger	Figure 1-5
111.476	1	Sieve Reflector Nozzle	Figure 1-6
112.028	1	Spoon Sieve Reflector Nozzle.	Figure 1-7
BTF-70791	2	Battery Discharge Cap	Figure 1-8
BTA-70834	1	Battery Adapter Plate	Figure 1-9
MCH-110	1	Field Carry Case	Figure 1-10
MCH-100-AM	1	Printed manual and Digital CD Copy	No Photo



**Figure 1-2. Heat Gun
111.038.1**



**Figure 1-3. 48DCV Power Supply
MCH-102NW**



**Figure 1-4. BB-390 B/U Battery
BT-70790**



**Figure 1-5. Universal Portable
Battery Charger
BTC-70819**



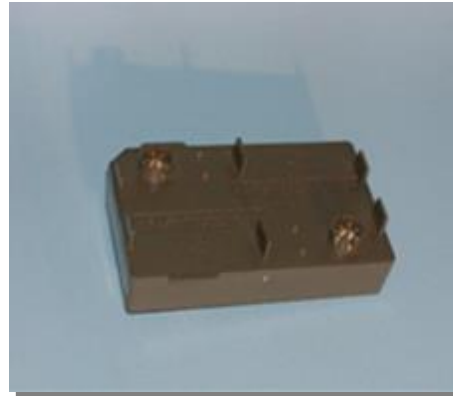
**Figure 1-6. Sieve Reflector Nozzle
111.476**



**Figure 1-7. Spoon Reflector Nozzle
112.028**



**Figure 1-8. Battery Discharge Cap
BTF-70791**



**Figure 1-9. Battery Adapter Plate
BTA-70834**



**Figure 1-10. Field Carry Case
MCH-110**

1-2. HEAT GUN - 111.038.1

- 1-2.1. The 111.038.1 Heat Gun, Figure 1-2, consists of a 300 watt ceramic resistance two-prong plug in type interchangeable heating element protected by a mica insulation tube, and a 25 watt carbon brushed electric motor fan that provides air flow. Heat Gun achieves operating temperatures within 30 seconds of operation. A built-in ON/OFF switch within the hot air tool allows the operator to turn the heating element on and off as needed. Changing various wattage heating elements and twist lock nozzle types allows temperature adjustments from +500° to +1050°F (+370° to +595°C). The Heat Gun is designed for use in electromagnetic sensitive environments and is protected through intrinsic electromagnetic filtering and shielding. 48VDC power is supplied by the MCH-102NW Power Supply, Figure 1-3, when connected via the Heat Gun's NC3MX-HD Quick Disconnect Connector.

1-3. 48DCV POWER SUPPLY – MCH-102NW

- 1-3.1. The MCH-102NW 48VDC Power Supply houses two 24-Volt BB-390 B/U Nickel Metal Hydride Batteries and supplies power to the Heat Gun, and additional MCH attachments and accessories. The Power Supply consists of an environmentally protective, watertight, and electromagnetic shielded molded fiberglass case with a built-in ON/OFF switch, power supply cable with NC3FX-HD Quick Disconnect Connector, push button air pressure equalizer valve, DC Power Dual Battery Balancing Connector, and anti-skip protection to prevent slipping when placed on a slick surface.

1-4. 24-VOLT BATTERY – BT-70790

- 1-4.1. The BT-70790 24-Volt BB-390 B/U Rechargeable and Sealed Nickel Metal Hydride smart battery, Figure 1-4, with state-of-charge liquid crystal display (LCD), is encased in a durable high impact ABS plastic housing. The battery features gold plated brass contacts for extended electrical hookup without corrosion, protection against possible cell reversal, rechargeable with up to 500 cycles, depending on use, preventative maintenance, and environment, and a shelf life of up to five years. Intrinsic overheating and improper charging prevention is controlled with a built-in temperature sensor system. Precise discharge and low voltage control is featured with a patented safety circuit to protect the batteries and overall system.

NOTE

The BB-390B/U Nickel Metal Hydride battery is the only battery that is approved for use with the MCH-102NW Power Supply.

1-5. UNIVERSAL PORTABLE BATTERY CHARGER – BTC-70819

- 1-5.1. The BTC-70819 Universal Portable Battery Charger is an intelligent, high performance, portable battery charging system that will reactivate two 24-Volt BB-390 B/U Rechargeable Nickel Metal Hydride batteries in approximately two hours. The battery charger is housed in an impact-resistant molded equipment case that is completely watertight when the cover is latched securely and the pressure equalizer relief valve on the bottom of the case is closed. The charging system is capable of charging many battery types. The appropriate battery adapter for the supplied BB-390 B/U batteries is included in the MCH-100-A Kit, and serves as the electrical interface between the batteries being charged and the charger circuits.
- 1-5.2. Two automatic cycles occur during a typical battery charge: 1) a fast rate charge cycle and 2) a low current trickle charge, which maintains the battery until it is removed. LED Light Indicators provide moment to moment state of charge status, including faults, and can be disengaged with the charging system's blackout feature. Computer-controlled charge sequencing and automatic circuit switching regulates battery charging at the respective battery adapter ports.
- 1-5.3. The charger is designed for worldwide deployment with multi-voltage input power capability. An integral five-foot power cable can be connected to the local AC supply receptacle when the unit is operated from an AC power source; a separate cable assembly is provided for operation from a 24-Volt DC source through the vehicle battery box NATO slave connector. The battery charger can also be used with shipboard 400 Hz AC systems.

NOTE

The BTC-70819(-4) Charger manufactured by Bren-Tronics is the only charger that can be used to recharge the BB-390B/U batteries.

1-6. SIEVE REFLECTOR NOZZLE - 111.476

- 1-6.1. The 111.476 Sieve Reflector Nozzle is designed for the application of heat shrink tubing. The nozzle uses a twist lock system to attach to the 111.038.1 heating element case. Consistent air temperature is maintained throughout the reflector nozzle by forcing air through sieve holes along the entire concave surface of the nozzle.

1-7. **SPOON REFLECTOR NOZZLE – 112.028**

1-7.1. The 112.028 Spoon Reflector Nozzle is designed for the application of heat shrink tubing. The nozzle uses a twist lock system to attach to the 111.038.1 heating element case.

1-8. **Battery Discharge Cap - BTF-70791**

1-8.1. The BTF-70791 Battery Discharge Cap is used to test and condition the BB-390 B/U batteries.

1-9. **BATTERY ADAPTER PLATE - BTA-70834**

1-9.1. The BTA-70834 Battery Adapter Plate is used as the interface for the BB-390 B/U batteries and the BTC-70819 Universal Charging System.

1-10. **FIELD CARRY CASE - MCH-110**

1-10.1. The MCH-110 Field Carry Case is designed with a shoulder strap for a technician to comfortably carry the Heat Gun and additional hot accessory such as the soldering iron attachment, the 48 VDC Power Supply, nozzle attachments, and manuals or reference guides to the job site in the field. The carry case utilizes a under the lid pocket system for storing nozzles, a dual insulated packet for storing two hot accessories, a rubber external traction system for preventing slipping when placed on a slick surface, and is produced using a chemically resistant fabric to withstand the rigors of the field.

1-11. **MCH-100-A TECHNICAL SPECIFICATIONS.**

MCH-100-A

Weight	Overall: 31 lb (15 kg) <ul style="list-style-type: none"> • Carry Bag (MCH-110) w/ 111.038.1, MCH-102NW, BT-70790 (2 Qty), 111.476 & 112.028 Nozzles: 17 lb (7.7 kg) • Charger (BTC-70819(-4)) w/ BTF-70791 (2 Qty) and BTA-70834: 14 lb (6.8 kg)
Shipment	No restrictions
Disposal	In accordance with local environmental regulations
Design Standards	<ul style="list-style-type: none"> • MIL-STD-461E (EMI) • MIL-STD-464 (EM ENVIRO. EFFECTS) • MIL-HDBK-235 (EM ENVIRO.) • MIL-STD-810F (511.4 – EXPLOSIVE ATMOSPHERE, 506.4 RAIN INTRUSION, 509.4 SALT FOG, 516.5 SHOCK) • CE MARKED (Available through Authorized Representative)
Dimensions	<ul style="list-style-type: none"> • MCH-110 Carry Case: 15 in x 12 in x 7.0 in • BTC-70819 Charger: 14 in x 11 in x 8.0 in

111.038.1 Heat Gun

Voltage	42 VDC
Ampere	8 A
Wattage	Total: 325 W <ul style="list-style-type: none"> • 111.182 Standard Element: 300 W • Internal Fan: 25 W
Airflow	2.66 CFM (75 L/min)
Air Pressure	16-mbar maximum
Temperature	+825° F (+440°C) with standard element. Adjustable w/ interchangeable elements and nozzles.
Case Material	Black ABS (Acrylonitrile Butadiene Styrene)
Dimensions	Size of hot air tool is 9.5" long x 3" x 1.6" diameter handle (stored inside MCH-110 Field Carry Case)
Weight	1 lb (0.45 kg)
Running Time	30+ continuous minutes with standard element.
Power Cord	Length: 1.5 ft

MCH-102NW 48 VDC Power Supply

Batteries (Ea)	<ul style="list-style-type: none"> • Voltage: 24 V, Two (2) 12 V Sections • Capacity: 4.9 Ah in 24 V Mode; 9.8 Ah in 12 V Mode • Operating Temperature: -4°F to +131°F (-20°C to +55°C) • Storage Temperature: -40°F to +104°F (-40°C to +40°C) • State of Charge Display: 5 Segment LCD's with Constant Display • Disposal: Environmentally safe – See Material Safety Data Sheet (MSDS) • Safety: Internal thermal shut down at +158°F (+70°C) • Safety: Internal low voltage shutdown at combined 35 V
Dimensions	9.0 in x 10 in x 6.5 in (stored inside MCH-110 Field Carry Case)
Color	Grey
Material	Molded Fiberglass
Power Cord	Length: 8.5 ft

MCH-110 Field Carry Case

Dimensions	15 in x 12 in x 7 in
Color	Olive Drab # 34088 Grey #26173 per FED-STD-595B
Material	Chemically Resistant PVC (Polyvinyl chloride)

BTC-70819(4) Universal Battery Charger

Power Requirements	<ul style="list-style-type: none"> • 90 to 125-Volts AC, single-phase, 60 Hz, 2 ampere; with 5 ft. • AC: Automatic Selection: 90 to 260 VAC, single-phase, 47 to 440 Hz • DC: 22 to 33 VDC, 13A
Charging Output Voltage	Automatically selected per installed charge adapter
Duty Cycle	Continuous
Protective Features	Resettable circuit breakers for AC (3A) and DC (13A)
Environmental and Performance Tests	<ul style="list-style-type: none"> • Operating Temp. Range: -4°F (-20°C) to +122°F (+50°C) • Storage Temp. Range: - 40°F. (-40°C.) to 158°F. (70°C.) • Loose Cargo Bounce Test: Meets requirements of MIL-STD-810E, Method 514.4, Category 3
Case Material	Solid Polypropylene
Case Color	Olive Drab # 34088 Grey #26173 per FED-STD-595B
Shipment	No restrictions
Dimensions	14 in x 11 in x 8.0 in

Any questions regarding operation, maintenance, repairs, parts, and accessories can be directed to Malcom Technologies through our toll free number from the USA at 800-289-7505 or from other parts of the world by calling 401-683-3199.

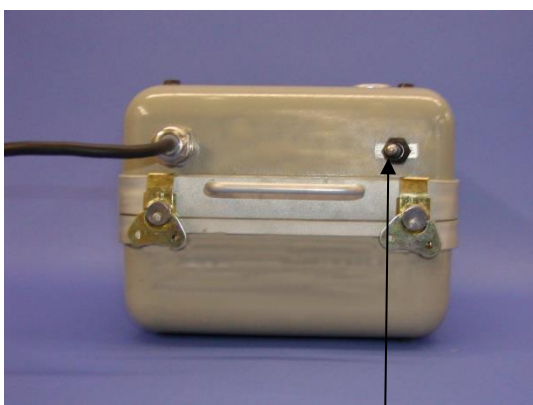
We also have a web site at www.malcom.com where you can place orders and email us with questions at any time. Email address: iono.bixby@malcom.com.

CHAPTER 2

Operating Procedures

2-1 HOT AIR TOOL CONTROLS

2-1.1 The MCH-100-A has two simple controls. Figure 2-1 shows the ON/OFF switch located on the MCH-102NW Power Supply that activates the power to the 111.038.1 Heat Gun. When the MCH-102NW switch is on, the fan in the heat gun will activate. Figure 2-2 shows the ON/OFF switch located on the handle of the heat gun. When the 111.038.1 switch is on, the heating element will activate.



ON/OFF

Figure 2-1. Power Supply Switch



ON/OFF

Figure 2-2. Heat Gun Switch

Item	Function
ON/OFF switch on battery box	Turns power on and off to the hot air tool. The fan starts up in the tool when the switch is on, Figure 2-1.
Hot Air Tool switch on back of tool	Turns the power on and off to the internal heating element, Figure 2-4.

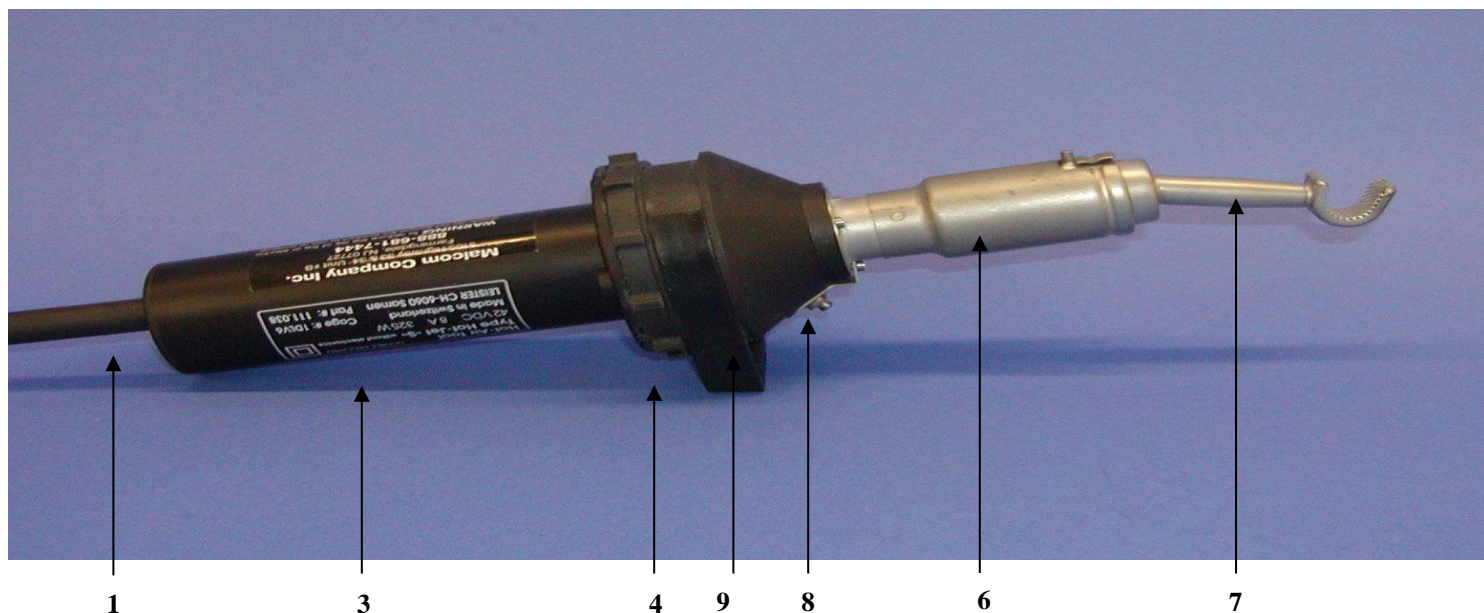


Figure 2-3. Heat Gun Parts List

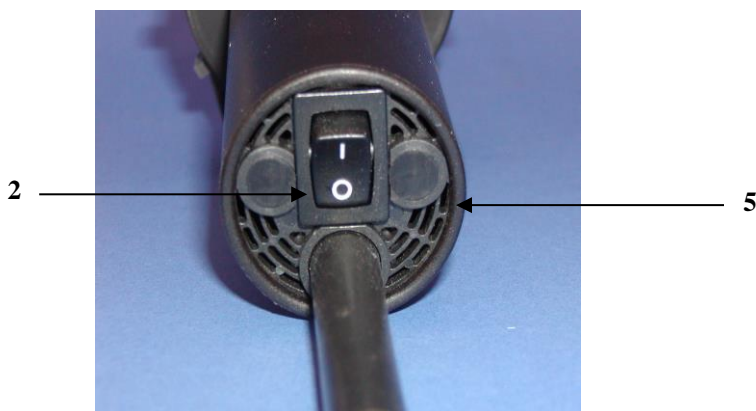


Figure 2-4. Hot Jet Switch

- | | |
|-----------------------|---|
| 1. Power Supply Cable | 6. Element housing |
| 2. On/Off switch | 7. Push-fit nozzle with twist lock |
| 3. Handle | 8. ESD-lead connection |
| 4. Rubber stands | 9. Tool stand (can be removed, rotated and fixed) |
| 1. Air filter | |

WARNING

HOT AIR TOOL CAN PRESENT A FIRE AND EXPLOSION HAZARD

The hot air tool must be used in a ventilated area. The internal heating element and built in fan motor may present a hazard when exposed to certain flammable vapors associated with, for example, gasoline, methane, jet fuel and propane.

2-2 UNPACKING TOOL.

- 2-2.1 Carefully remove from the packaging the heat gun, power pack, batteries, charger and the accessories that were ordered with the tool.
- 2-2.2 Check the itemized packing list and/or Chapter 1 against what was delivered to be sure that every item was received.
- 2-2.3 Save the packaging in a dry storage area should you need to transport this tool to another location.
- 2-2.4 Pressure release valves are installed on the power pack and charging case to equalize pressure where an imbalance may have occurred during transportation. The valve on the MCH-102NW 48VDC Power Supply is a push-button type equalizer; simply push the black button to equalize the pressure. The pressure equalizer on the BTC-70819 Battery Charger is a black twist valve located below the handle.

2-3 CONNECTION OF BATTERY TO THE HEAT GUN.

- 2-3.1 Batteries must be fully charged before it is used with the heat gun. See Chapter 5 for instructions on charging the batteries.
- 2-3.2 Open battery case on a flat surface, Figure 2-5.
- 2-3.3 Install the battery connector by push-fitting it onto the two batteries as shown in Figure 2-6 and 2-7.
- 2-3.4 Push-fit the batteries together with the connector into the case as shown in Figure 2-8. Tuck power cord between battery side and case as shown in Figure 2-8.
- 2-3.5 Close the lid and secure the latches, Figure 2-9.
- 2-3.6 Install the power pack case into the carry case if provided, Figure 2-12.



Figure 2-5. Battery Enclosure



Figure 2-6. Batteries



Figure 2-7. Battery Converter



Figure 2-8. Batteries Inserted



Figure 2-9. Heat Gun and Power Supply



Figure 2-10. Heat Gun and Power Supply in Carry Case

2-4 **SETUP PROCEDURES.**

- 2-4.1 As required, push-fit, twist and lock appropriate nozzle, (7) Figure 2-3, onto the heat gun. Many air nozzles are available for various hot air applications like shrink tubes, soldering and plastic welding.
- 2-4.2 A clip is provided on the tool for Electrostatic Discharge or ESD. If you are using the tool on printed circuit boards where static discharge may cause damage to the electronics, then you will need to earth the tool via the ESD lead connection located on the hot air tool, (8) Figure 2-3.
- 2-4.3 Switch on the power at the power pack, Figure 2-1.
- 2-4.4 Switch on the power at the hot air tool, (2) Figure 2-4, and allow to warm up for about one minute prior to use.

2-5 CHANGE OF HOT AIR NOZZLES.**WARNING****HOT AIR TOOL CAN CAUSE BURNS**

Every effort should be made to avoid contact with the hot air tool stainless steel heating element cover and attached nozzles during operation because this part of the tool becomes very hot and can cause burns. Do not point the hot air flow in the direction of people or animals.

- 2-5.1 To remove nozzle twist and pull away from the heating element cover.
- 2-5.1.1 To prevent burns while changing nozzles, the tool should be allowed to cool down by turning off the heat using the switch on the heat gun, (2) Figure 2-4. The fan should be kept running to cool the nozzle down. If a hot nozzle must be removed, then turn off the power to the tool and use only combination pliers and/or insulated gloves to remove the hot nozzle.
- 2-5.2 To install nozzle push and twist into heating element cover. See Figure 2-11.
- 2-5.2.1 It is recommended to turn the fan off during nozzle installation.

WARNING**HOT NOZZLES CAN CAUSE BURNS**

Do not touch hot nozzle with bare hands and make sure to place the hot nozzle onto a heat resistant surface or drop it into the insulated pocket in the MCH-110 Carry Case.

- 2-5.3 Only MCH approved nozzles should be installed on the heat gun.



Figure 2-101. Sieve Nozzle Attached

2-6 CHARGING BATTERIES.

- 2-6.1 Carefully remove batteries from power supply.
- 2-6.2 Install the BTA-70834 Battery Adapter Plate into the BTC-70819 Universal Portable Battery Charger.
- 2-6.3 Place the batteries onto charger adapter plate as outlined in Chapter 5 of this manual.
- 2-6.4 Batteries should be periodically completely discharged prior to charging to maintain calibration. See Chapter 6.
- 2-6.5 Charging status is indicated by the Battery Charging System's LED state of charge lights and should be complete within 2 hours. See Chapter 5.

WARNING

NO SMOKING IS PERMITTED NEAR THE CHARGING STATION AND HOT AIR TOOL

Batteries can produce explosive gases during charging or discharge cycles. Never smoke or allow open flames near the charging station or the hot air tool while they are in use.

CAUTION

ACID CONTAMINATES NICKEL-METAL HYDRIDE BATTERIES

Every effort must be made to keep Nickel-Metal Hydride batteries as far away as possible from lead acid batteries because lead acid batteries contain sulfuric acid. Do not use the same tools and material such as, screwdrivers, wrenches, syringes, hydrometers and gloves for both types of batteries. Any trace of acid or acid fumes will permanently damage Nickel-Metal Hydride batteries on contact.

2-7 PREPARATION FOR MOVEMENT AFTER USE.

- 2-7.1 Set the Heat Gun power switch to OFF to let the tool cool down.
- 2-7.2 When Heat Gun is cool, set the Power Supply power switch to OFF on the to stop the fan in the tool.
- 2-7.3 Remove any installed nozzles and place them into the appropriate storage pockets in the carry bag, Figure 2-12.
- 2-7.4 Disconnect the Heat Gun's NC3MX-HD Quick Disconnect Connector from the Power Supply's NC3FX-HD Quick Disconnect Connector.
- 2-7.5 Insert the Power Supply, Heat Gun, and Coiled Power Supply Cable into the appropriate locations as indicated on the screen print on the inside of the MCH-110 Carry Bag Lid, Figure 2-13.
- 2-7.6 Close and secure the Carry Bag Lid.



Figure 2-12. Carry Bag With Compartments



Figure 2-13. Properly stowed components

2-8 PREPARATION FOR SHIPMENT AND STORAGE.

2-8.1 Begin with Section 2-7 to properly store components.

2-8.1.1 Disconnect batteries from the Power Supply connector. Store batteries in Power Supply Container as if they were connected to the Power Supply Connector and rotate Connector to protect flanges.

2-8.2 Insert Universal Battery Charger and Carry Bag into shipping container with adequate padding and bracing to prevent damage.

2-8.3 Secure shipping container and ship or store in cool dry area.

2-9 PREPARATION FOR STORAGE OF BB-390 BATTERY.

2-9.1 Remove Batteries from Power Supply.

2-9.2 Fully charge batteries at room temperature.

2-9.3 Store battery in cool dry area.

2-10 PREPARATION FOR SHIPMENT OF BB-390 B/U BATTERY.

2-10.1 Remove Batteries from Power Supply.

2-10.2 Fully charge batteries at room temperature.

2-10.3 Pack batteries in a cushioned container. Battery is not hazardous and has no shipping restrictions.

2-11 OPERATION IN UNUSUAL WEATHER CONDITIONS.

2-11.1 Observe these precautions when the MCH-100-A is operated in areas where severe climatic conditions may exist.

2-11.1.1 Operation in Arctic Climates - The hot air tool is designed to function in temperatures as low as 32°F, (0°C.). However, the following precautions should be observed:

2-11.1.1.1 Handle equipment carefully.

2-11.1.1.2 Keep equipment clean and dry.

2-11.1.1.3 Prevent ice from forming on the equipment. Ice formations may prevent proper electrical connections.

2-11.1.1.4 Battery and hot air tool performance decreases as the temperature drops.

- 2-11.1.2 Operation in Desert Climates – Temperature extremes of 122°F (50°C), and dryness associated with desert environment will not affect equipment usage. However, the built-in thermal safety switch inside the batteries will automatically shut the power off if the interior battery temperatures reach 158°F (70°C).
- 2-11.1.2.1 In order to prevent thermal shutdown, turn off the hot air tool once your work is complete. Try to avoid running the tool longer than 10 minutes at one time.
- 2-11.1.2.2 Dust storms associated with desert climates may cause poor electrical connections and prevent proper operation. When operating in these conditions, the filter on the back of the hot air tool should be kept clean by periodically brushing as it gets blocked.
- 2-11.1.2.3 Charging batteries in hot desert environment may take two charge cycles.
- 2-11.1.3 Operations in Salt Spray - Keep equipment clean and dry at all times and immediately wipe salt spray from exposed surfaces, cables and connectors.
- 2-11.1.3.1 When not in use, be sure that cover is fully latched and the hot air tool is stored in the storage bag with the bag flaps in place.

Any questions regarding operation, maintenance, repairs, parts, and accessories can be directed to Malcom Technologies through our toll free number from the USA at 800-289-7505 or from other parts of the world by calling 401-683-3199.

We also have a web site at www.malcom.com where you can place orders and email us with questions at any time. Email address: jono.bixby@malcom.com.

CHAPTER 3

Maintenance Instructions

WARNING

HIGH VOLTAGES ARE PRESENT IN THE OPERATION OF THIS EQUIPMENT!!

Avoid contact with the DC and AC supply voltage connections during installation, operation, or maintenance of the MCH-100-A and its battery charging system. Disconnect the batteries before opening the tool.

WARNING

HOT AIR TOOL IS SHIELDED FOR ELECTROMAGNETIC EMISSIONS AND ENVIRONMENTAL EFFECTS

The hot air tool is manufactured to meet certain EMI requirements as specified by USA Military and CE Standards. Tampering with the electromagnetic (EMI) shield or not following repair instructions outlined in the technical manual, may affect the integrity of the EMI shield and result in radiated emissions coming from the tool above the approved limits.

3-1. PREVENTATIVE MAINTENANCE PROCEDURES

3-1.1. HEAT GUN PREVENTATIVE MAINTENANCE

3-1.1.1. HEAT GUN CLEANING

3-1.1.1.1. Use compressed air to spray-clean the Heat Gun intake air filter periodically, approximately every 250 hours, depending on use.

3-1.1.1.1.1. The filter for the air intake to the hot air tool is located on the back of the heat gun.

3-1.1.1.2. Remove the Heat Gun Heating Element Cover as described in Section 3-3.1. Remove the Heat Gun Heating Element as described in Section 3-3.4.

3-1.1.1.3. Look through the Heating Element air holes at the internal heating coils. If coils are dirty/dusty, then spray-clean the internal heating coils through the Heating Element air holes with compressed air.

3-1.1.1.3.1. If the Heating Element internal heating coils require cleaning, then remove the Heat Gun Handle, as described in Section 3-3.8, and spray-clean the internal components with compressed air. Use a water dipped cotton swab for especially hard to remove dirt/dust.

3-1.1.1.4. Replace the Heating Element, Heating Element Cover, and Heat Gun Handle as required and as described in Section 3-3.

3-1.2. **BATTERY PREVENTATIVE MAINTENANCE**

3-1.2.1. **BATTERY CONDITIONING AND CALIBRATION** – Annual conditioning and calibration of the BB-390 Batteries (PN: BT-70790) will ensure maximum performance of the MCH-100-A system.

3-1.2.1.1. Remove batteries from the 48 VDC Power Supply.

3-1.2.1.2. Visually inspect each battery for visible damage.

3-1.2.1.3. Push-fit the Self-Discharge Cap (PN: BTF-70791) onto each Battery and allow each Battery to completely discharge as indicated by the unlit Self-Discharge Cap LEDs.

3-1.2.1.3.1. A fully charged BB-390 will require (24) twenty-four hours to completely discharge using the Self-Discharge Cap. Discharge times will decrease as the charge in each Battery decreases.

3-1.2.1.4. Install Batteries onto the charger and allow Batteries to recharge.

3-1.2.1.5. Remove the Batteries from the charger. The State-of-Charge displays on the Batteries should now show (5) five segments completely filled in. If not, then repeat discharge/charge sequence (1) one additional time. Voltages at Battery Pins 1-4 and 2-5 should show 13.25-volts.

3-2. **TROUBLESHOOTING PROCEDURES**

3-2.1. The following paragraphs provide instructions for fault isolation, testing, component replacement procedures and checkout of the equipment.

3-2.1.1. **Visual Inspection** - Visually inspect the Heat Gun and Power Supply to find faults.

3-2.1.1.1. Check to see that the Power Supply and Heat Gun switch is in the ON position.

3-2.1.1.2. Check to see that the BB390 B/U NiMH Batteries (PN: BT-70790) are charged and securely connected.

3-2.1.1.3. Check to see that the Heat Gun is securely connected to the Power Supply. Check to see that the Power Supply cable is not compromised: Abraded, Chaffed, or Charred.

3-2.1.2. **Operational Checkout** - Perform the operating procedures given in Chapter 2. Note at which point in the procedures that the Heat Gun does not function or operates improperly: No Heat, No Air/No Power.

- 3-2.1.3. **Troubleshooting Method** - Troubleshooting procedures described in Table 3-1 are based on observing problems that occur during operation under conditions that occur during normal use of the unit. Proceed with step-by - step checkout of the Heat Gun and its components until the defective part is found and replaced and the problem is corrected.

WARNING

Unless otherwise noted, troubleshooting and repair procedures are performed with power switches OFF and power cables disconnected from the power source.

3-2.1. TABLE 3-2 – TROUBLESHOOTING PROCEDURES**NO AIR/ POWER**

1. Is the Power Supply ON/OFF Switch in the ON position?
2. Is the accessory (Heat Gun) securely connected via the Quick Disconnect Connectors?
3. Are the (2) two Batteries used the correct type (BB-390 B/U NiMH, PN: BT-70790)?
4. Are the Batteries charged and operational?
 - a. See Chapters 2 for Operating Procedures, Chapter 5 for Charger Information, and Chapter 6 for Battery Information.
5. Is the Battery Connector securely connected to the Batteries?
 - a. The Power Supply Power Cord should be replaced if the Battery Connector tabs are broken or the junction between Connector A and Connector B is loose. See Power Supply Power Cord Replacement instructions in Section 3-4.
6. Are any electrical connections compromised (cut, cracked, abraded, chaffed, or charred that exposes the internal shield or conductors)? Check the Power Supply Power Cord, Accessory Power Cord, and connections inside the Power Supply container.
 - a. The Power Supply Power Cord should be replaced if the external or internal Power Supply Power Cord is compromised. See Power Cord Wire Harness Replacement instructions in Section 3-4.
7. Are the Heat Gun Fan Motor's Carbon Brushes properly set?
 - a. See Section 3-3.9 for checking carbon brushes.
 - b. See Section 3-3.10 for resetting and replacing carbon brushes.
8. Is the Power Supply Switch operational?
 - a. See Section 3-4 for replacing the Power Supply Cable.

DECREASED PERFORMANCE

Decreased Run Time or Air Temperature

1. Is the Heat Gun clear of dirt and dust?
 - a. See Section 3-1 for Heat Gun Cleaning.
2. Are the batteries conditioned?
 - a. See Section 3-1.2 for Battery Conditioning and Calibration.

NO HEAT

The fan is running and is blowing ambient air.

1. Is the Heating Element operational?
 - a. See Section 3-3.5 to Check the Continuity of the Heating Element. Replace if Heating Element fails a Continuity Test.
 - b. See Section 3-3.6 to Replace the Heating Element.
 2. Is the Heat Gun switch operational?
 - a. See Section 3-3.11 for replacing the Heat Gun Switch.
-

**LOW BATTERY
VOLTAGE**

1. Are the Batteries conditioned?
 - a. See Section 3-1.2 for Battery Conditioning and Calibration.
 2. Are the Battery, Battery Charger, and Battery Adapter operational?
 - a. See Chapters 2 for Operating Procedures, Chapter 5 for Charger Information, and Chapter 6 for Battery Information.
-

**INACCURATE
STATE-OF-
CHARGE
INDICATORS**

1. Are the Batteries conditioned?
 - a. See Section 3-1.2 for Battery Conditioning and Calibration.
 2. Are the Batteries operational.
 - a. See Chapters 2 for Operating Procedures, Chapter 5 for Charger Information, and Chapter 6 for Battery Information.
-

3-3. HEAT GUN MAINTENANCE INSTRUCTIONS

3-3.1. REMOVE HEATING ELEMENT COVER

- 3-3.1.1. Disconnect Heat Gun from Power Supply. Remove the three screws that attach the Heat Gun Element Cover to the Heat Gun Handle, Figure 3-1.
- 3-3.1.2. Slide off the Element Cover and Mica Tube, Figure 3-2.



Figure 3-1. Element Cover



Figure 3-2. Cover Removed

3-3.2. REPLACE SEPARATION RING (PN: 100.802)

- 3-3.2.1. Remove the Heating Element Cover as described in Section 3-3.1.
- 3-3.2.2. Remove the damaged Heating Element Cover Separation Ring (PN: 100.802) by sliding it over the heating element.
- 3-3.2.3. Install new Separation Ring, Figure 3-3 by sliding over the heating element. Reinstall the Heating Element Cover as described in Section 3-3.
- 3-3.2.4. Replace the Heating Element Cover as described in Section 3-3.7.



Figure 3-3. Separation Ring
100.802

3-3.3. **REPLACE GROUND CLIP (PN: 107.227)**

- 3-3.3.1. Loosen the Heating Element Cover screw that fastens the Heat Gun Ground Clip to the Heat Gun and remove damaged Ground Clip, Figure 3-4.



**Figure 3-4 Heat Gun Ground
Clip 107.227**

- 3-3.3.2. Install the new Heat Gun Ground Clip (PN: 107.227) and tighten the screw. Use a seizing compound like, Loctite Blue, Part No. 24200, when reinstalling the Element Cover Screw.

3-3.4. **REMOVE HEATING ELEMENT**

- 3-3.4.1. Remove the Heating Element Cover as described in Section 3-3.1.
- 3-3.4.2. Unplug the Heating Element from the Heat Gun Handle by pulling straight upwards, Figure 3-5.



**Figure 3-5. Heating Element
Disassembled**

3-3.5. CHECK CONTINUITY OF HEATING ELEMENT

- 3-3.5.1. Remove the Heating Element as described in Section 3-3.4.
- 3-3.5.2. Using an audible continuity tester, connect one lead to one element prong and the second lead to the second element prong.
 - 3-3.5.2.1. An audible beep means that the continuity is intact.
- 3-3.5.3. If continuity test fails, then replace the Heating Element as described in Section 3-3.6. If the Heating Element passes the continuity test, then reinstall the Heating Element Cover as described in Section 3-3.7 and replace the Heat Gun Switch as described in Section 3-3.11.

3-3.6. REPLACE HEATING ELEMENT

- 3-3.6.1. Remove the damaged Heating Element as described in Section 3-3.4.
- 3-3.6.2. Push fit the new Heating Element to the Heat Gun Handle.
- 3-3.6.3. Slide the Heating Element Mica Tube over the Heating Element and reinstall the Heating Element Cover as described in Section 3-3.7.

3-3.7. REINSTALL HEATING ELEMENT COVER

- 3-3.7.1. Slide the Element Cover over the Heating Element and Mica Tube.
- 3-3.7.2. Fasten the Element Cover to the Heat Gun Handle using the three screws previously removed. Use a seizing compound like, Loctite Blue, Part No. 24200, when reinstalling the Element Cover screws.

3-3.8. REMOVE HEAT GUN HANDLE

- 3-3.8.1. Disconnect the Heat Gun from the Power Supply. Remove the three screws from the handle, Figure 3-6.
- 3-3.8.2. Carefully slide the Heat Gun Handle back over the cable. Excessive force may snap the Heat Gun Filter Screen and Heat Gun Switch Bracket. Slowly work the Handle back and forth while the Handle is being pulled, Figure 3-7.
- 3-3.8.2.1. EMI protection in the 111.038.1 Heat Gun starting with Serial Number 992142 has been changed from a nickel metal painted shield to a Stainless Steel Sheet Shield, Figure 38. Heat Gun Handles from kits or marked with Serial Numbers less than 992142 should be removed with extra care to prevent damage to EMI protective paint. Removed paint may break the integrity of the EMI shield. The continuity of the shield can be tested using an audible continuity tester.



Figure 3-6. Heat Gun Handle Screws



Figure 3-7. Exposed Heat Gun Handle EMI Protection



Figure 3-8. Exposed internal Heat Gun Components

3-3.9. **CHECK CARBON BRUSH**

- 3-3.9.1. Remove the Heat Gun Handle as described in Section 3-3.8.
- 3-3.9.2. Inspect the (2) two Carbon Brushes located on opposite sides of the fan motor in between the Heat Gun Heating Element and the Heat Gun Internal Components. The Heat Gun Fan Springs should be hooked on to the Carbon Brushes, Figure 3-9.
- 3-3.9.3. Remove the brush to check for damage and to measure the length of the brush, Figure 3-10 & Figure 3-11.
 - 3-3.9.3.1. If the brush length is less than 0.25 in. or is cracked, then it should be replaced.
- 3-3.9.4. Replace the Carbon Brushes as described in Section 3-3.10.

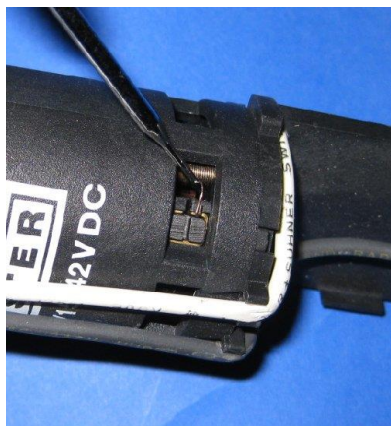


Figure 3-9. Carbon Brush Hooks



Figure 3-10. Remove Carbon Brush

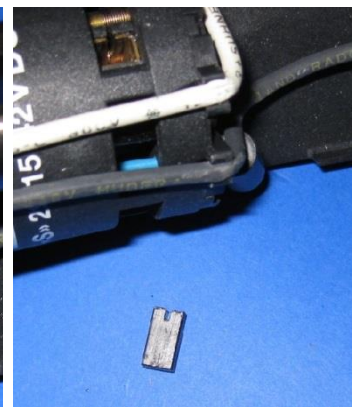


Figure 3-11. Carbon Brush Removed

3-3.10. REPLACE AND RESET CARBON BRUSH (PN: 100.066)

3-3.10.1. Install Carbon Brush into the Heat Gun Fan slot with the notch facing outwards, Figure 3-12.

3-3.10.2. Use a small hook to latch the spring in the notch of the Carbon Brush, Figure 3-13. Replace the Heat Gun Handle as described in Section 3-3.14.



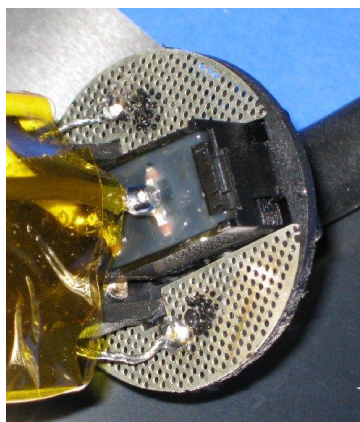
Figure 3-12. Replace Carbon Brush



Figure 3-13. Reset Carbon Brush Spring

3-3.11. REPLACE HEAT GUN SWITCH (PN: 102.969)

- 3-3.11.1. Remove the Heat Gun Handle as described in Section 3-3.8.
- 3-3.11.2. Remove the yellow High Temperature Kapton Insulation Tape from the Heat Gun Switch wire connection points, Figure 3-14.
- 3-3.11.3. Desolder the (2) two conductors from the back of the Heat Gun Switch.
- 3-3.11.4. To remove the Switch, press down on the clip on the top of the Switch near the break in the Heat Gun Filter Screen.
- 3-3.11.5. Push fit the replacement Switch into place.
- 3-3.11.6. Solder the desoldered leads onto the switch.
- 3-3.11.7. Replace the Handle as described in Section 3-3.14.



**Figure 3-14. Heat Gun Switch
Internal Wiring**

3-3.12. REPLACE HEAT GUN POWER CORD (PN: MCH-114)

- 3-3.12.1. Remove the Heat Gun Handle as described in Section 3-3.8.
- 3-3.12.2. Remove the Heat Gun Power Cord Clamp as described in Section 3-3.13.
- 3-3.12.3. Loosen the Heat Gun Power Cord Lead Screws, Figure 3-15.
- 3-3.12.4. Carefully cut the ground wires that are soldered to the Heat Gun Screen Filter on either side of the switch, 0.25 in. from the Filter, without pulling on the screen, Figure 3-16.
- 3-3.12.5. Remove the Heat Gun Power Cord by gently pulling it through the Heat Gun Rubber Cable Restraint.
- 3-3.12.6. Slide the replacement Power Cord, MCH-114, through the Rubber Cable Restraint.
- 3-3.12.7. Insert the white power conductor into the left Lead Screw and tighten. Insert the black power conductor into the right Lead Screw and tighten, Figure 3-15.
- 3-3.12.7.1. Polarity is not critical. Tool left is defined by Technician's Point of View with the Heat Gun Heating Element farthest from the Technician.
- 3-3.12.8. Solder the Power Cord's ground wires to the solder points on either side of the switch, Figure 3-16.
- 3-3.12.9. Replace the Power Cord Clamp as directed in Section 3-3.13.
- 3-3.12.10. Replace the Handle as directed in Section 3-3.14.



Figure 3-15. Power Cord Lead Screws

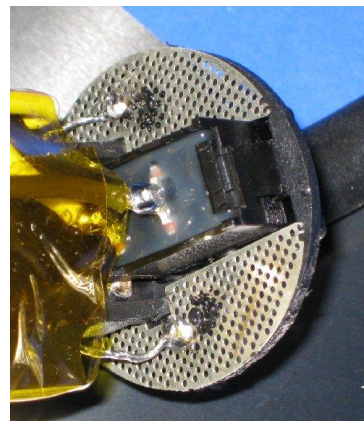


Figure 3-16. Ground wires soldered to filter.

3-3.13. REPLACE POWER CORD CLAMP (PN: 100.808 and 100.775)

- 3-3.13.1. Remove the Handle as directed in Section 3-3.8.
- 3-3.13.2. Remove the yellow High Temperature Kapton Insulation Tape that covers the Heat Gun Power Cord Lead Screws and Clamp.
- 3-3.13.3. Remove the screws and Power Cord Clamp Washers (PN: 100.775) from the Power Cord Clamp (PN: 100.808), Figure 3-17.
- 3-3.13.4. Remove the Power Cord Clamp from the Heat Gun.
- 3-3.13.5. Replace the Power Cord Clamp (PN: 100.808), Power Cord Clamp Washers (PN: 100.775) and Power Cord Clamp Screws, Figure 3-18.
- 3-3.13.6. Replace the Handle as directed in Section 3-3.14.



**Figure 3-17. Power Cord Clamp
Screws**



**Figure 3-18. Power Cord Clamp
Screws, Washers, and Clamp**

3-3.14. REPLACE HEAT GUN HANDLE

- 3-3.14.1. Wrap internal components in new High Temperature Insulation Kapton tape, Figure 3-19.
- 3-3.14.2. Replace Heat Gun Handle EMI Stainless Steel Shield by positioning shield so that the bottom edge of the shield touches the stainless steel Heat Gun Filter where the Power Cord is connected to the Heat Gun, Figure 3-19.
- 3-3.14.3. Wrap the shield around the Heat Gun Internal Components, Figure 3-20.
- 3-3.14.4. Slide the Heat Gun Handle over the EMI Shield, Figure 3-21. The Handle is keyed to fit the Heat Gun Filter.
- 3-3.14.4.1. The shield will slightly overlap as the Handle is reinstalled.
- 3-3.14.5. Replace removed Heat Gun Handle Screws. Use a seizing compound like, Loctite Blue, Part No. 24200, when reinstalling the Handle Screws.

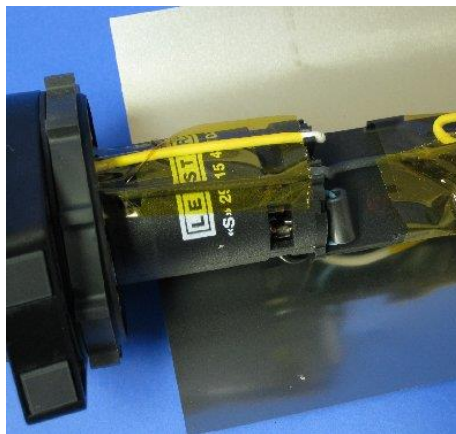


Figure 3-19. High Temperature Insulation Tape and Heat Gun EMI Shield Placement.



Figure 3-20. Wrap shield around internal components and replace handle.



Figure 3-21. Handle Key Fit on Heat Gun

3-4. 48 VDC POWER SUPPLY MAINTENANCE INSTRUCTIONS**3-4.1. REMOVE POWER SUPPLY POWER CORD**

3-4.1.1. Open the MCH-102NW Battery Power Supply Case and remove the failed MCH-103.2 Output Wire Harness ON/OFF switch from the MCH-102NW by loosening the ON/OFF Switch External Locking Nut.

3-4.1.1.1. Save the ON/OFF Switch Rubber Boot and ON/OFF Plate to use when installing the replacement Output Wire Harness.

3-4.1.2. Inside the Power Supply Case, remove the failed Output Wire Harness Grounding Wire from the Power Supply Handle Screw.

3-4.1.3. Cut the failed Output Wire Harness Power Cable near the base of the Failed NC3FX-HD Quick Disconnect Female Connector.

3-4.1.4. Loosen the Power Supply Case Power Cord Feed-through Restraining Clamp and pull the failed Power Cord through. Positively identify the failed Power Cord as failed and discard or segregate from other replacement parts.

3-4.1.5. REPLACE POWER SUPPLY POWER CORD (PN: MCH-103.2)

3-4.1.6. Feed the prepped cable end of the MCH-103.2 Output Wire Harness, Figure 3-21, through the inside of the Power Cord Feed-through Restraining Clamp of the MCH-102NW Battery Power Supply Case.



Figure 3-21. MCH-103.2 Output Wire Harness

3-4.1.7. Remove one Output Wire Harness ON/OFF Switch Locking Nut from the ON/OFF Switch Toggle Switch and tighten the second Locking Nut to the base of the Switch.

3-4.1.8. Install the ON/OFF Switch in its through-hole so that the Switch is facing the outside of the Power Supply Case.

- 3-4.1.9. Install the ON/OFF Switch Plate on the Switch so that the plate is parallel to and the OFF side of the Switch Plate is closest to the handle of the Power Supply Case.
- 3-4.1.10. Install and tighten the Switch Locking Nut on top of the ON/OFF Toggle Switch Plate.
- 3-4.1.11. Install the ON/OFF Switch Rubber Boot so that the part number and text of the Rubber Boot is facing outward and closest to the outside of the Switch Locking Nut.
- 3-4.1.12. Install the Wire Harness Ground Wire to the Power Supply Case Handle Screw on the inside of the Power Supply Case farthest from the Switch.
- 3-4.1.13. Pull the excess Power Cord through the MCH-102NW Battery Power Supply Case Power Cord Feed-through Restraining Clamp and tighten the Clamp.
- 3-4.1.14. Take the NC3FX-HD Quick Disconnect Female Connector apart by unscrewing the External Cable Restraint from the Quick Disconnect Connector.
- 3-4.1.14.1. There should be four pieces to the NC3FX-HD. From Left to Right in Figure 3-22 there is an External Cable Restraint, Internal Plastic Cable Restraint, Pin Connector, and Quick Disconnect Connector.
- 3-4.1.14.1.1. The Internal Plastic Cable Restraint and Pin Connector may need to be pushed through the Quick Disconnect Connector house through the opposite opening from the Quick Disconnect Connector threads.



Figure 3-22. NC3FX-HD Quick Disconnect Connector



Figure 3-23. NC3FX-HD Assembly

3-4.1.14.2. Slide the External Cable Restraint onto the Power Cable making sure that the threaded end of the External Cable Restraint is facing the prepped Power Cable conductors.

3-4.1.14.2.1. Note: If the MCH-102NW Power Cable is not prepped, then start by first stripping back the Power Cable jacket (1) one inch. Strip back the two black and white conductors (1/4) one quarter inch and tin with solder. Take the braided wire shield and twist into a (1) one inch tail. Tin with solder and shrink (3/4) three quarters of inch tubing over tail.

3-4.1.14.2.2. Note: Talc powder or liquid soap may need to be applied to the end of the Power Cable jacket to aid in sliding the External Cable Restraint onto the Power Cable.

3-4.1.15. Slide the Internal Plastic Cable Restraint onto the Power Cable making sure that the narrow conical opening of the Plastic Cable Restraint is facing away from the prepped Power Cable conductors.

3-4.1.16. Solder the white conductor of the Power Cable into terminal #1 of the Pin Connector. Solder the black wire into the terminal labeled #2. Solder the braided shield onto the stainless steel terminal.

3-4.1.16.1. Note: Be sure to distinguish between the black conductor and the twisted braided shield insulated with shrink tube that may also be black.

3-4.1.17. Carefully push the parts together. The threaded end of the Quick Disconnect Connector is keyed to fit the Pin Connector and Internal Plastic Cable Restraint correctly. Twist together hand tight the External Cable Restraint to the Quick Disconnect Connector.

3-4.1.18. Install the Output Wire Harness Battery Terminal into the Power Supply Case by running the Battery Terminal Cable down the side of the Power Supply Case that is closest to the Power Cord Feed-through Restraining Clamp.

3-4.1.19. Press the cord into the Power Supply Case Foam Cord Opening to prevent the cable from pinching when the case is closed.

3-4.1.20. Place the Battery Terminal in the foam insulation structure of the Power Supply Case so that the Battery Terminal Pins are facing the hinges of the Power Supply Case and the open side of the three sided flange is towards the top of the Power Supply Case.

3-5. CHECKOUT AFTER REPAIR.

3-5.1. Once the repair has been completed, install freshly charged batteries into the battery pack as described in Chapter 2

3-5.2. Follow the operating instructions as described in Chapter 2 of this manual.

3-6. WIRING DIAGRAM

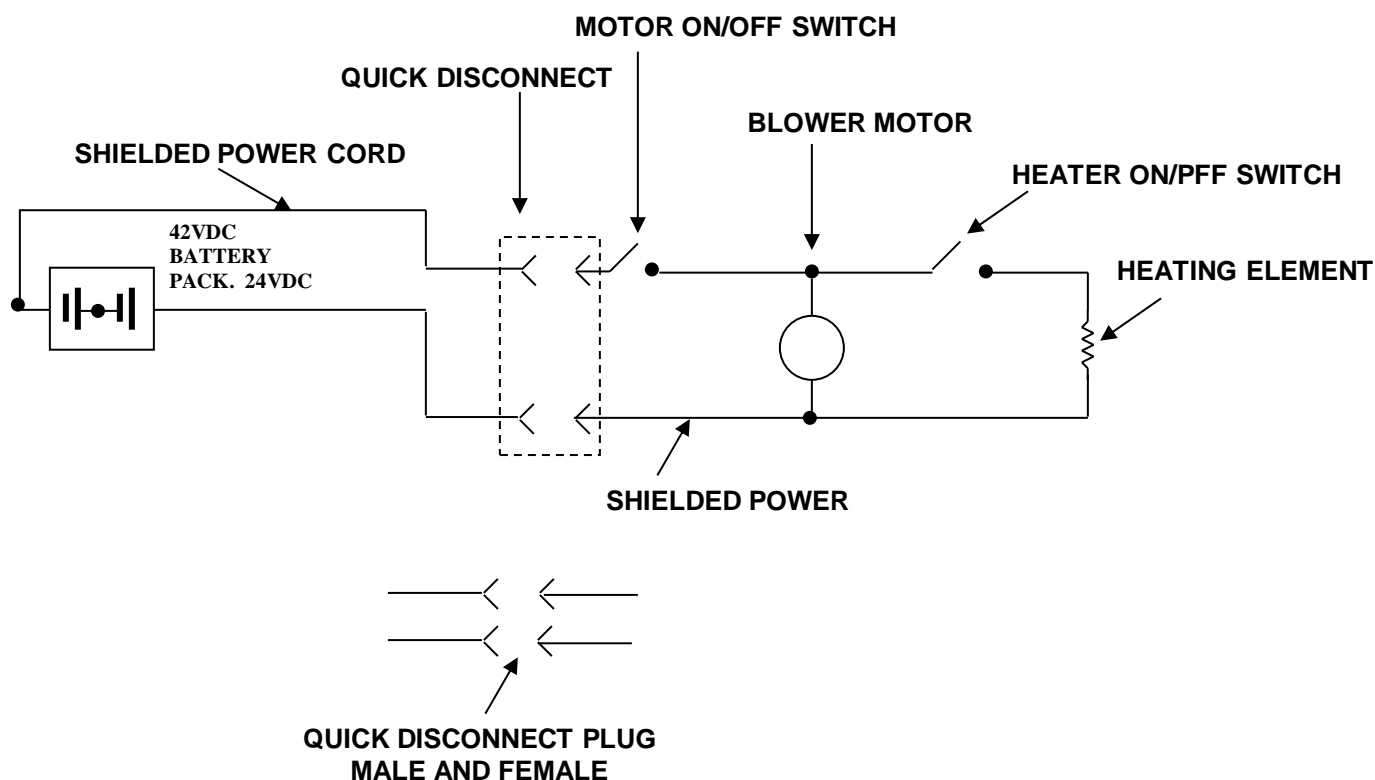


Figure 3-3. Wiring Diagram

Any questions regarding operation, maintenance, repairs, parts, and accessories can be directed to Malcom Technologies through our toll free number from the USA at 800-289-7505 or from other parts of the world by calling 401-683-3199.

We also have a web site at www.malcom.com where you can place orders and email us with questions at any time. Email address: jono.bixby@malcom.com.

CHAPTER 4

MCH-100-A Spare Parts

4-1. **INTRODUCTION**

- 4-1.1. This chapter lists and illustrates authorized repair parts required for maintenance and repair of the MCH-100-A Battery Powered Heat Gun Assembly.
- 4-1.2. The four most commonly replaced MCH-100-A components and recommended spare parts for the repair shop are spare Heat Guns (111.038.1), Heat Gun Heating Elements (111.182), Power Supply Power Cords (MCH-103.2), and NiMH BB-390/BU Rechargeable Batteries (BT-70790).
- 4-1.3. Table 4-3 provides a list of additional available replacement parts for the MCH-100-A.

4-2. **EXPLANATION OF COLUMNS**

- 4-2.1. Table 4-3 includes the following information:
- 4-2.2. **ITEM NO.** – Indicates the number used to identify items called out in Figures 4-1 and 4-2.
- 4-2.3. **PART NO.** – Indicates the Malcom Part Number, which controls the design and characteristics of the item.
- 4-2.4. **DESCRIPTION** – Provides a brief description of the referenced part.
- 4-2.5. **QUANTITY** – Indicates the quantity of the item used in the MCH-100-A.

4-2.1. TABLE 4-2 – SPARE PARTS LIST

Item No.	Part No.	SM&R Code	Description	Quantity
<u>MCH-100-A Components</u>				
11	111.038.1	PAOGG	Heat Gun	1
12	MCH-102NW	PAGZZ	48VDC Power Supply	1
13	MCH-110	PAGZZ	Carry Case	1
27	BTA-70834	PAOZZ	Battery Charger Adapter	1
28	BT-70790	PAOZA	BB-390/BU 24-volt rechargeable battery (NiMH)	2
29	BTC-70819	PAOZA	Universal Battery Charger	1
30	BTF-70791	PAOZA	Battery Discharge Caps	2
32	111.476		Sieve Reflector Nozzle	1
33	112.028		Spoon Reflector Nozzle	1
<u>111.038.1 Heat Gun Components</u>				
14	111.182	PAGZZ	Heating Element, 42V, 300W	1
16	MCH-114	PAGZZ	Heat Gun Power Cord	1
17	100.811	PAGZZ	Commercial screw, Heat Gun Handle (M3x.5x6mm)	3
18	100.817	PAGZZ	Commercial screw, Element Cover (M3x.5x8mm)	3
19	100.819	PAGZZ	Mica tube	1
20	100.802	PAGZZ	Separation distance ring	1
21	100.816	PAGZZ	Commercial screw, Power Cord Clamp (M3x.5x8mm)	2
22	100.775	PAGZZ	Commercial washer, Power Cord Clamp (M3)	2
23	100.808	PAGZZ	Power Cord Clamp, plastic	1
24	100.807	PAGZZ	Cable Restraint, rubber	1
25	9d.22.02	PAGZZ	Heat Gun Element Cover, bayonet type	1
26	107.227	PAGZZ	Ground clip	1
<u>MCH-102NW 48VDC Power Supply Components</u>				
15	MCH-103.2	PAGZZ	Power Supply Power Cord	1
<u>BTC-70819 Universal Battery Charger Components</u>				
31	BTC-70819-PC	PAGZZ	Battery Charger Power Cable	1



Figure 4-1. MCH-100-A Components

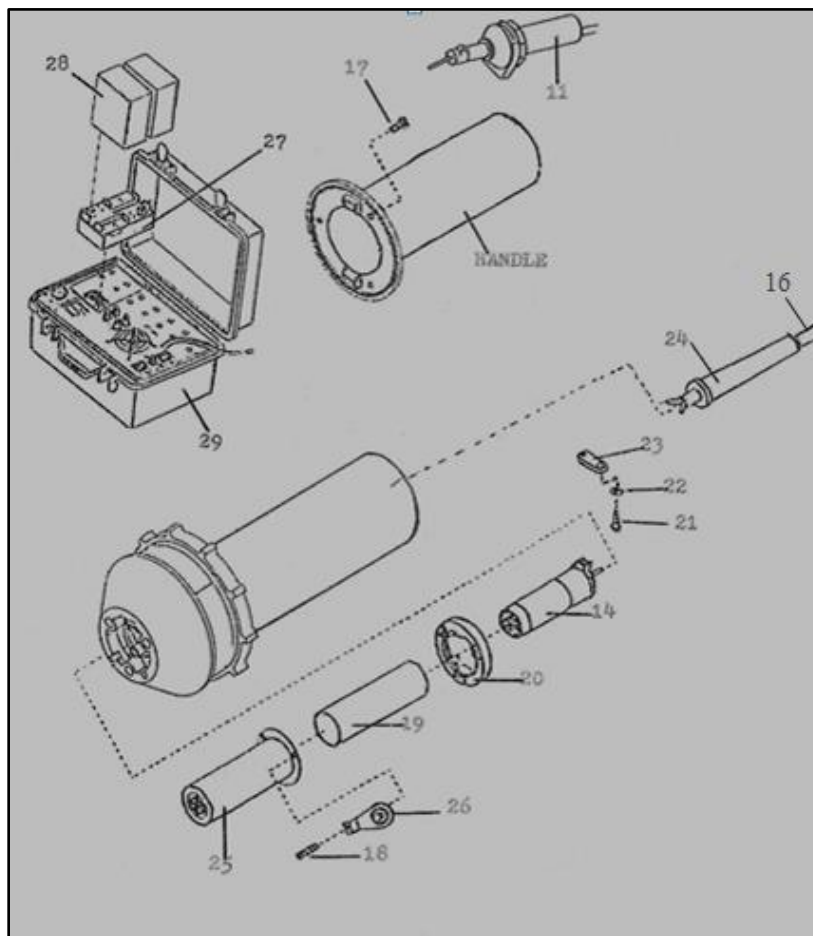







Figure 4-2. Assembly Components

4-3. **ACCESSORIES FOR THE MCH-100-A**

- 4-3.1. Over 500 nozzle accessories are available for the MCH-100-A Heat Gun including soldering and de-soldering nozzles for SMD components, speed welding tips for plastic welding, and overlap welding tips for tent and tarp welding. See Table 4-4.
- 4-3.2. Higher power heating elements are available at 350w and 400w.
- 4-3.3. Additional battery powered accessories, such as the MCH-116 Soldering Iron, MCH-100-HMD Hot Melt Iron, MCH-100-HB Hot Bonder are available and can be designed for different applications.

TABLE 4-4

Figure	Description	Part Number
	Sieve reflector nozzle for solder and shrink sleeves. Bayonet coupling to match 111.038.1 Heat Gun Fitting, included with the MCH-100-A Assembly.	111.476
	Spoon reflector nozzle for solder and shrink sleeves. Bayonet coupling to match 111.038.1 Heat Gun Fitting, included with the MCH-100-A Assembly.	112.028
	Sieve reflector nozzle for solder and shrink sleeves. Six inch long extension nozzle with sieve reflector and bayonet coupling to match 111.038.1 Heat Gun Fitting, included with the MCH-100-A Assembly.	111.474

	<p>Spoon reflector, 20 mm, for soldering, shrink sleeves, and molded parts.</p> <p>Bayonet coupling to match 111.038.1 Heat Gun Fitting, included with the MCH-100-A Assembly.</p>	111.478
	<p>Round nozzle, 5 mm, for soldering.</p> <p>Bayonet coupling to match 111.038.1 Heat Gun Fitting, included with the MCH-100-A Assembly.</p>	112.025

Any questions regarding operation, maintenance, repairs, parts, and accessories can be directed to Malcom Technologies through our toll free number from the USA at 800-289-7505 or from other parts of the world by calling 401-683-3199.

Multimedia How To's, Product Resources, and Accessory Development Projects are available on our web site at www.malcom.com or by emailing Jono Bixby at jono.bixby@malcom.com.

CHAPTER 5

SPC Lite

Universal Portable Charger

Dual-Position

PN: BTC-70819

NSN 6130-01-555-7817



5-1. OPERATION AND SERVICE MANUAL.

See included Bren-tronics, Inc. OPERATION AND SERVICE MANUAL SPC LITE, Universal Portable Charger, Dual-Position, BTC-70819.

Any questions regarding accessories can be directed to Malcom Company through our toll free number from the USA at 800-289-7505 or from other parts of the world by calling 401-683-3199. We also have a web site at www.malcom.com where you can place orders for parts and accessories and email us with questions at any time.

CHAPTER 6

48v NiMH Rechargeable Battery, BB-390B/U

Part #: BT-70790

NSN#: 6140-01-490-4317



6-1. SCOPE.

6-1.1. The BB-390B/U (PN: BT-70790) 48v NiMH Rechargeable Battery is a state-of-the-art, high performance battery manufactured by Bren-Tronics. This battery is typically used in applications, such as Communications, Chemical, CLU, Computer, Robotics, and various other applications requiring battery power including powering devices such as SINCGARS & ATCS (AN/PRC-104, 117, 119), FALCON (AN/PRC-138, 117) KY-57, MXF430 (V), AN/PSC-5, M22, JAVELIN, LRAS and various other battery powered equipment.

The BT-70790 rechargeable battery was designed for the U.S. Department of Defense and its friendly allied nations and is manufactured in accordance with U.S. military specifications MIL-PRF-32052/1 and ISO 9000 requirements.

6-2. FEATURES.

- High reliability due to all-welded construction
- Durable high impact plastic housing and connector enclosure
- Gold Plated brass contacts for extended electrical hookup without corrosion
- State-of-charge display with LCD readout
- Protection against possible cell reversal
- Rechargeable up to 500 cycles, depending on use, and shelf life up to five years
- Improper charging prevented by built-in temperature sensors
- Automatically displays remaining capacity of battery
- Precise discharge and low voltage control with patented safety circuit
- Power to the heat gun will automatically shut off when voltage drops below 35-volts

6-3. BB-390B/U OPERATION.

6-3.1. The MCH-100-A is a robust tool that subjects the BB-390B/U battery power source to rapid discharge. Starting with a fresh charge and 75°F ambient temperatures, the tool should operate continuously for 26-28 minutes. Continual run generates greater internal heat and, if combined with high ambient temperatures, will ultimately cause the thermal protective circuitry to shut down the tool prematurely. Using the tool in short bursts will not generate as much heat and the tool can be operated for a longer period before a recharge will be necessary.

6-3.2. The batteries incorporate two LCD readouts for a visual state-of-charge display. A full battery will display five LED segments in each of the two displays on the top of the battery. As the battery is used during the heat gun operation, the LCD will display a decreasing number of segments. Each segment represents about 20% (five minutes) of run time of the heat gun, Section 6-8. The two LCD displays should be identical when they are calibrated. The last segment usually remains on the longest.

6-3.3. The BB-390 batteries including with the MCH-100-A are fully charged as part of standard procedures before final test and assembly. However, all rechargeable batteries lose one percent of their charge in 24 hours of shelf time. Thus, when the tool is unpacked for use in the field, the batteries may be well below charge levels at manufacture. They might even have gone into “sleep mode”; therefore, it is strongly recommended that each battery be preconditioned before initial use, see Section 6-4.

NOTE

Even though the battery manufacturer rates the BB390B/U battery for 500 cycles, the actual cycles of these batteries when used in the MCH-100-A tool will most likely be less than 500. How much less will depend on the way the tool is used and the environmental conditions it is subjected to.

6-4. USE OF THE BB-390B/U BATTERIES IN THE MCH-100-A.

1. Prior to first use, each individual BB-390B/U battery must be preconditioned. This requires two (2) full charge/recharge cycles. Follow the discharge procedures outlined in Sections 6-6 and 6-7 of this manual. This will prepare the battery for optimal performance. This procedure is critical to the longevity of the battery in actual operation. Failure to conduct these initial charge/recharge procedures may shorten the life of the battery.

2. Always ensure that the batteries are carrying a charge prior to going out on the job. Using a standard volt/ohm meter, measure the voltage of each side of the battery section to be sure that is a minimum of 13.25-Volts. Check the LED indicators for charge condition. Each segment indicates about five minutes operating time. If this is not the case, recharge the batteries.

NOTE

If there is any doubt that the batteries are not fully charged, replace them with batteries that show full charge and operational readiness. This can only occur by following good maintenance practice. If only one set of batteries are available, they must be routinely cycled for charge/discharge freshening. See Chapter 3, Preventative Maintenance Instructions.

3. The MCH-100-A uses two BB-390B/U batteries. Always use batteries from the same lot. Try to avoid mixed batteries from different lots and date codes. It is essential for optimal performance that the batteries share equally in the operational requirements of the heat gun tool. A weak battery will be the limiting factor in tool run time.

NOTE

While it may be necessary to use whatever battery is available, proper mating within the circuitry is good practice. Whenever possible, replace both batteries with matched performance pairs. Check the date codes for warranty. Do not mix BB-390A/U older batteries with the newer version BB-390B/U. Both versions, however, will operate the MCH-100-A.

4. Never attempt to force charge a warm battery. Batteries should be cooled to room temperature prior to process. Upper and lower extremes in temperature are damaging to any battery and rechargeable type batteries need to be handled with attention to longevity.
5. The MCH-100-A Battery Powered Heat gun depends on the proper treatment of the power source. Current versions of the tool that are using the 300 watt element, will operate for approximate 26-28 minutes before thermal protection or low voltage shuts the tool down. This is a protective circuit built into the battery pack. The battery will then require a cooling down period and normal recharge on the standard military PP-8444A/U Universal Battery Charger with the BB-390 adapter plate.

6. In a very hot operating environment, run time of the heat gun may be less. Protect the Power Pack from extremes of ambient temperatures. Sitting on the tarmac in a desert sun will preheat the BB-390s and shorten the run time of the heat gun.
7. Batteries should be cooled to room temperature before they are recharged and the batteries should be cooled to room temperature after charging is complete before using the MCH-100-A.

NOTE

The BB-390 battery is the only battery that has been approved to be used with the MCH-100-A Heat gun. The PP-8444A/U Charger manufactured by Bren-Tronics, is the only charger that can be used to recharge the BB-390 batteries.

6-5. BATTERY TROUBLESHOOTING.

6-5.1. When should the batteries be replaced?

1. Batteries are fully charged when a voltmeter shows 13.25-volts or greater. If the voltage in any of the sections is less than 13.25-volts after being charged, then the battery needs to be placed on the charger again. If after the second charge cycle they do not show 13.25-volts, then the batteries must be discarded and replaced with a new battery.

NOTE

The PP-8497/U (BB-390 self-discharge Cap shown in Section 6-7 in this manual, can be used as a quick checker that ensures that both 12-volts sections within the battery are working fully. Thus, in a matter of minutes, you could quickly check all your BB-390's stocks to ensure they are good to go on both 12-volt sections.

2. The batteries are SMART and contain internal printed circuit boards with electronics that control the way the batteries function. The batteries are fully sealed. However, due to mishandling, the case and/or the connectors can crack exposing the inside of the batteries to the environment, which could affect the performance of the battery. If the case becomes cracked, then the battery should be discarded and replaced.

6-5.1.1. **MALFUNCTION 1:** The batteries are fully charged, yet the LCD screens do not indicate a full charge.

1. The LCD displays can become out of calibration, thus displaying false LED segments under two circumstances as described below.
 - a. Long term storage - If the battery has not been used for a period exceeding two months, then the internal program that controls the LCD displays will indicate less capacity than is actually present in the cells. Some cells could go into “sleep mode”. Follow the procedures in Sections 6-6 or 6-7, to wake up the sleeping cells.
 - b. Continuous battery discharge with the heat gun being on for extended periods of time could **WARNING** the LCD displays to become out of calibration. If the heat gun is used in the continuous mode, then internal heat will build up within the batteries. The thermal safety switches within the battery will automatically turn the batteries off. As a result of thermal switch activation, the internal program that controls the LCD displays will indicate less capacity than is actually present in the cells once the batteries are recharged.

6-5.1.2. **MALFUNCTION 2:** One 12-volt section shows full charge when checked with a voltmeter and the other 12-volt section does not.

1. If one of the 12-volt sections in the BB390 battery does not fully charge while the other section shows a less than full charge, then maybe one of the small cells within the 12-volt section has fallen asleep and needs to be woken up or, it is faulty. Follow the procedures in Sections 6-6 and 6-7 to wake up the sleeping cells.
 - a. Long term storage without recharging every two months or improper storage in very cold or very hot conditions can cause a deactivated cell. Before discarding the battery, reset the internal cells by completely discharging the battery. Follow the discharge procedure outlined in Sections 6-6 and 6-7 as well as in the corrective action section below.

6-5.1.3. **MALFUNCTION 3:** The MCH-100-A run time is less than 20 minutes even after a fresh complete discharge and recharge cycle.

1. Each BB-390 has two 12-volt sections. Although your BB-390's may charge up well, displaying full State-of-Charge (SOC) readings and providing 13.25-volts or better at pins 1-4 and 2-5 after a charge, there may be internal damage to one of the cells or the printed circuit board that will prevent normal use in either or both 12-volt sections.
2. One of the internal cells may be "asleep" and needs to be conditioned.

6-5.2. **CORRECTIVE ACTION**

1. Check each BB-390 with the Self-Discharge Device (CAP) PP-8497/U, shown in Section 6-7 of this manual, which places a load and provides a quick check on each 12-volt section of the BB-390.

6-5.2.1 BB-390 Quick Check Instructions Using the Self-Discharge Device (CAP) PP-8497/U.

1. Ensure the BB-390 has been charged in the last 60 days. If not, then charge the battery.
2. Place Self-Discharge Device (CAP) on the BB-390.
 - a. If both LED's light "green", your battery is OK. Both 12-volt sections are discharging properly. Remove CAP and go on to next battery
 - b. If one or both LED's do not light "green", then the BB-390 requires reconditioning or is damaged. See Section 6-6.

NOTE

Ensure Self-Discharge Device (CAP) is working with known good battery when you first use device. If the battery fails just after a charge, wait one hour for the battery low temp cut off to reset and then retest with cap. Condition Batteries. Batteries must be completely discharged before they are charged again. It is recommended that you do this twice. There are two ways to discharge the BB-390 battery outlined in Sections 6-6 and 6-7 in this manual.

6-6. RECONDITION BATTERY. Batteries will operate properly even with LCD's out of calibration.

1. Completely discharge battery according to Section 6-6 or Section 6-7.
2. Recharge the batteries using the P-8444A/U "Universal Charger". After the charge is complete, the LCD segments should be calibrated.
 - a. If not, allow batteries to cool, and then run another charge cycle. If not after a second charge cycle, ensure voltages at pins 1-4 and 2-5 are at least 13.25-volts. If voltages are correct then repeat discharge charge cycle. If voltages are under 13.25-volts, then the battery, charger, or adapter may be damaged.
3. Allow batteries to cool before use.

6-7. DISCHARGE PROCEDURE USING THE HEAT GUN.

1. Turn heat gun fan on. DO NOT turn on the heating element.
2. Run heat gun on fan only until it automatically turns off due to the internal voltage cutoff switch. This protects the batteries and the heat gun from low voltage operation. This will empty the battery. The discharge time will vary depending on how much capacity was remaining in the batteries.
3. Remove the batteries from the MCH-100-A battery case. Let them stand and cool down for one hour. Recharge the batteries using the P-8444A/U "Universal Charger".

6-8. DISCHARGE PROCEDURE USING THE SELF-DISCHARGE CAP.

6-7.1. This is the preferred method of discharge as it does not require the use of the MCH-100-A heat gun. The PP-8497/U, Self-Discharge Device (Cap), NSN: 6130-01-490-4310 is available from Malcom Company. The PP-8497/U device will assist in conditioning and maintaining BB-390 batteries, Figure 6-1.



Figure 0-1. BB-390 Self-Discharge Device (Cap) and Good Battery Quick Check Device

NOTE

The discharge device is not intended to measure how long the battery will run your equipment. The device is intended as a quick sanity check for ensuring both 12-volt sections are working and for discharging the battery. You still must ensure the BB-390 is fully charged prior to use.

6-7.2. **Discharging.** The cap will discharge the BB-390 without requiring a power outlet or running the heat gun. Discharge times will vary. A fully charged BB-390 will require 24 hours using the self-discharge device. Discharge times will drop dramatically if the BB-390's have been discharged during use. A full discharge/recharge cycle is recommended quarterly to ensure good operating performance of the BB-390's.

6-7.2.1. Discharging Instructions.

1. Ensure cap is working with known good battery when you first use device.
2. Place Self-Discharge Device (CAP) on the BB-390.
 - a. If both LED's light "green", your battery is OK. Both 12-volt sections are discharging properly. The discharge will continue until the lights turn off.
 - i. If one or both LED's DO NOT light "green", then the BB-390 requires troubleshooting.

6-9. STATE-OF-CHARGE (SOC) BATTERY DISPLAYS.

The batteries are equipped with State-of-Charge displays that indicate the battery charge status using a five-segment LCD readout.

<u>Segments</u>	<u>State-of-Charge</u>
0	0% (fully discharged)
1	0 to 24%
2	24 to 42%
3	42 to 65%
4	65 to 92%
5	92 to 100% (fully charged)

NOTE 1: Batteries have two State of Charge (SOC) Indicators. Both indicators have to be 100% for the battery to be 100%.

NOTE 2: If batteries have been recharged but State of Charge (SOC) indicators show less the 100% then the LCD readouts must be recalibrated as outlined in Section 6-6 of this manual.

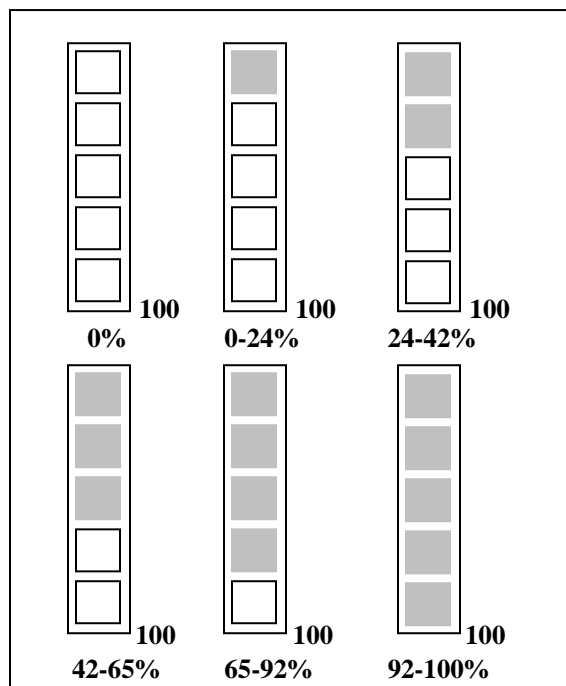


Figure 0-2. State-of-Charge Battery Display

6-10. TESTING SPECIFICATIONS.

6-10.1. The BB-390B/U has been tested to MIL-PRF-32052/1

6-11. REPAIR OF BB-390 BATTERIES.

6-10.1. BB-390 batteries are not repairable. If a fault occurs, the battery must be replaced. Dispose of faulty battery according to local environmental regulations.

6-12. BB-390 TECHNICAL SPECIFICATIONS.

Description	Rechargeable, Nickel Metal Hydride with “State-of-Charge Display”
National Stock Number	6140-01-490-4317
For Use In	AN/PRC-104, AN/PRC-117F, AN/PRC-119 (SINCGARS) & KY-57 Radios
Replacement for	BB-390A/U, BB-590/U, BA-5590/U, BB-490/U, BB-690/U
Nominal Dimensions	
Length, Width & Height	4.400 in (112 mm) 2.450 in (62 mm) 5.000 in (127 mm)
Nominal Weight	3.880 Lb (1.76 Kg)
Nominal Voltage	24.0-V, Two (2) 12.0-V Sections
Nominal Capacity	4.9 Ah @ 24.0-V – 9.8 Ah @ 12.0-v
Cutoff Voltage	20.0-V - 10.0-V
Operating Temperature Range	-20°C to +55 °C (-4°F to +131°F)
Storage Temperature Range	-40°C to +55°C (-40°F to +131°F)
Case Material & Color	Modified ABS plastic, Olive Drab #34088 with White printing
Connector	Floating Type Per U.S. Army DWG # SC-C-179495
Operational Life	10.0 Hours @ 0.360 Amps, When used in 24-Volt Mode
Applicable Q.A. Specification	MIL-STD-105, MIL-STD-810, MIL-STD-454
Applicable Battery Specification	MIL-B-49436(B)(ER) and Proposed U.S. Army (NMH) Specification
Shelf Life	Up to five years, dependent on storage conditions
Recommended Chargers	PP-8444A/U, PP-8481A/U (COTM), PP-8498/U (SPC)
Standard Charge	Charge each section at constant current of 480 mA for 12 hour Disposal Environmentally Safe – Contains Zero (0)% Mercury or Cadmium. Check with local regulations for proper disposal.

Any questions regarding accessories can be directed to Malcom Company through our toll free number from the USA at 800-289-7505 or from other parts of the world by calling 401-683-3199. We also have a web site at www.malcom.com where you can place orders for parts and accessories and email us with questions at any time.

CHAPTER 7

Warranty Information

7-1. MCH-100-A HOT AIR TOOL.

7-1.1. Malcom Company warrants goods supplied under the order conform to specifications supplied and are MERCHANTABLE and fit for the particular purposes for which goods are ordinarily employed.

1. Seller further warrants to the Buyer and to any party ultimately using any item whether such third party is a customer of Buyer or not, that all items delivered under the order will be free from defects in material and workmanship and will conform to applicable specifications, drawings, samples and descriptions.
2. The foregoing express warranties shall be, in addition to any warranty customarily made by Seller of its products and any implied warranties shall be construed as conditions as well as warranties.
3. Seller's warranty shall extend for a period of 12 months (365 days) after the item is delivered and accepted by buyer. Heating elements are not covered by the terms of this warranty.
4. The warranties represented and covenants of parties outlined shall survive the delivery of the goods or completion of the work or services provided and is fully enforceable thereafter. Seller's warranty is part consideration for the order; any payment by buyer is conditional upon warranty remaining in effect and no modification or other change of this warranty shall be valid unless evidenced by Buyer's written change order.
5. Seller undertakes to repair free of charge and damage occurring to tools that is established by Seller to result from defects in production. In order for repair to be effected in accordance with the provisions currently valid, tools must be returned to Seller's works carriage paid and free of charges.
6. No replacement will be effected in the event of incorrect use, unauthorized repair interference with the tool and normal wear and tear.
7. Seller's liability will exclusively comply with the sections specified under warranty, as well as the currently valid general conditions of business and terms of delivery. Any claims on the part of the buyer for compensation of damages against Seller, which are not expressly granted in the above sections, irrespective of the sort of claim or its basis in law, particularly claims arising from violation of accessory contractual obligations, for loss and damage in transit, from positive breach of contract, for consequential loss of damage arising from defects (in as much as these are not covered by contractual guarantee), from buyer's claims of recourse resulting from product liability, from buyer's claims for commercial material damages due to defective products, etc., are excluded unless these are the result of unlawful intent or gross negligence.

7-2. BB-390 BATTERY WARRANTY.

7-2.1. 12 months (365 days) from date code printed on battery according to Bren-Tronics warranty.

7-3. BATTERY CHARGER BB-390B/U WARRANTY.

7-3.1. 12 months (365 days) from date code printed on charger according to Bren-Tronics warranty.

7-4. SERVICE FORMS.

7-4.1. Any request for service repair must be authorized by the Malcom Company Service Department before the item is returned to the Company for Service. The buyer shall pay any freight charges that may be incurred. Please go to the Malcom website: www.malcom.com, and download the service form.

On the following pages are the required service forms that must accompany all tools returned for service.

Any questions regarding warranty issues, operation, maintenance, repairs, parts, service and accessories can be directed to Malcom Company through our toll free number from the USA at 800-289-7505 or from other parts of the world by calling 401-683-3199. We also have a web site at www.malcom.com where you can email us with questions at any time. Email address: jono.bixby@malcom.com.



SERVICE FORM

REV 100513

Page **1** of **3**

Date: _____

Customer Name:

Telephone#: _____ **Fax#** _____

Email: _____

Address: _____

City: _____

State: _____ **Zip Code:** _____

Shipper #: _____ **Circle one: UPS, FED EX, DHL, OTHER:** _____

Tool Type: _____

Tool Serial #: _____

Description of Problem: _____



SERVICE FORM

REV 100513

Page 2 of 3

To be completed by Malcom Company Service Center

Service Repair #: _____ Customer PO # _____

Date received by Malcom _____

Date of Customer Authorization _____

Customer Shipper #: _____

Date shipped to Customer: _____

Total Labor: _____

Total Parts: _____

Warranty and Service Policy:

Warranty is twelve months on every tool except the heating element. Any attempted repair or disassembly by other than an authorized repair station will void the warranty. Warranty repairs are done at the Malcom Company Service Center Portsmouth, Rhode Island.

RMA (Returned Material Authorization); is required prior to any shipment of product to Malcom Company. Repairs and/or replacement will only be performed on authorized returns. **If a shipment does not include an Authorization Label, the shipment will be refused and the product returned to sender.** When requesting an RMA number, please provide the serial number of the product (if available). For RMA and Shipping Control Label, contact, Jono Bixby, Repair Service at jono.bixby@malcom.com

Or call Toll Free: **800-289-7505**, outside the US **(401) 683-3199**. Fax # **(401) 683-3177**

All tools returned to Malcom Company for warranty work or general service must be shipped prepaid to:

Malcom Company, Inc.
Service Center, RMA# _____
207 High Point Ave. Unit 7b
Portsmouth, RI 02871

Please include your name and telephone number so that we can contact you with the repair estimate. Tools returned for service should not include nozzles or accessories, as we cannot be held responsible for their return. Repairs are generally done within 24 hours of receipt. Estimates will be given before any work is started. Damaged tool reassembly without repair will be charged for the inspection. Tools repaired will be credited for the inspection charge. Replacement parts and Labor are covered under a six-month warranty. If the Tool is under warranty, repairs will be performed and the tool returned to sender. For warranty repairs the sender must provide a shipper number for the tool to be returned on. If repair and/or replacement charges are required, estimated costs will be advised to the sender prior to any work starts.

Minimum Repair Rates: \$35 inspection fee on all repairs, waved if repair is authorized, \$80 Hand Tools, \$150 Process Heaters & Blowers, \$275 Automatic Machines & Extruders, Labor Rate \$80/hour



SERVICE FORM

REV 100513

Page 3 of 3

The repairs will not be performed without customer approval and payment arranged for the service.
I have read the Warranty and Service Policy and agree to the terms:

Print Name: _____

Signature: _____

Date: _____



**PLEASE COMPLETE PAGE 1 AND 3 OF THIS FORM AND INCLUDE
ALL 3 PAGES WITH YOUR RETURNS.**

**PRINT AND ATTACH THE FOLLOWING LABEL WITH THE RMA# FILLED IN ON
PACKAGE THAT CONTAINS THE RETURNED PRODUCT, OTHERWISE THE SHIPMENT
WILL BE REFUSED AND WILL BE RETURNED TO YOU.**

RMA# _____

**MALCOM COMPANY
ATTN: SERVICE
SERVICE CENTER
207 HIGHT POINT AVE. UNIT 7B
PORTSMOUTH, RI 02871**

OPERATION AND SERVICE MANUAL

SPC LITE



Universal Portable Charger Dual-Position BTC-70819

NSN 6130-01-555-7817



USA Tel: (631) 499-5155 • Fax: (631) 499-5504
email address: sales@bren-tronics.com
www.bren-tronics.com



WARNING

HIGH VOLTAGES ARE PRESENT IN THE OPERATION OF THIS EQUIPMENT

Avoid contact with AC supply voltage connections during installation, operation or maintenance of the battery charger.

CAUTION

ACID CONTAMINATES NICKEL-CADMIUM, LITHIUM-ION, LITHIUM-POLYMER and NICKEL-METAL HYDRIDE BATTERIES

Every effort must be made to keep Nickel-Cadmium, Lithium-Ion, Lithium Polymer and Nickel-Metal Hydride batteries as far away as possible from Lead-Acid batteries because Lead-Acid batteries contain sulfuric acid. Do Not use the same tools and materials, such as screwdrivers, wrenches, syringes, hydrometers, and gloves for both types of batteries. Any trace of acid or acid fumes will permanently damage Nickel-Cadmium, Lithium-Ion, Lithium Polymer and Nickel-Metal Hydride batteries on contact.



WARNING

NO SMOKING IS PERMITTED NEAR THE CHARGING STATION

Batteries can produce explosive gases during charging or discharge cycles. Never smoke or allow open flames near the charging station.

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CHAPTER 1 INTRODUCTION

1-1. SCOPE

The Soldier Portable Charger Lite (P/N BTC-70819) is a state-of-the-art, high performance lightweight portable battery charger designed for field deployment or shop usage. It provides fast reactivation of various rechargeable batteries. It is capable of simultaneously charging two batteries completely unattended.

The Soldier Portable Charger Lite (SPC Lite) is simple to use by design. Without any user intervention, the SPC Lite typically charges two batteries. The charge time for a fully discharged BB-2590/U or BB-390B/U is less than 3.5 hours. The Charge times are substantially less for partially discharged batteries. The charger automatically identifies the specific battery type and provides the appropriate charge profile. Based on the current operating environment, the SPC Lite automatically customizes the charge profile to provide the quickest charge in a safe manner. The charge status for the two batteries is conveyed to the user via three easy-to-understand panel mounted LED indicators (amber – CHARGE, green – READY and red – FAULT).

The SPC Lite is universal by design. It can readily use either AC or DC input power – whichever is most convenient for the user. The universal AC input fully allows 90-264 VAC and 47-440 Hz operation without any adjustment or user intervention. Additionally, the DC input power permits a range of 22-33 VDC, standard on most military vehicles. The Charger is available with an additional 12 VDC input. This allows the Charger to be powered from an 11-18 VDC such as a standard 12 VDC automotive system. When operated with either DC power source, an Under-voltage Lockout Circuit prevents the Charger from excessively discharging the vehicle battery so there is always enough power to restart the vehicle.

The SPC Lite is adaptive by design. It is microprocessor controlled and is presently programmed to automatically charge over 50 different battery types (and growing) as listed in Table 1. With the appropriate battery adapter, however, it can be readily reprogrammed via the RS232 software upgrade port in the field to charge a countless number of additional battery types and chemistries including: Nickel Metal Hydride, Nickel Cadmium, Lithium Ion, and Lithium Polymer.

The battery charger components are housed in a durable, solid polypropylene case. The assembled unit is watertight when the cover is securely latched and the pressure equalization valve is closed.

1-2. TECHNICAL SPECIFICATIONS

Dimensions..... 13.73 inches (348.8 mm) W x 10.28 inches (261 mm) D
x 7.65 inches (194.4 mm) H

Weight (less adapters and cables).....13 lbs. (5.9 kg)

Power Requirements

AC Operation.....Automatic Selection: 90 to 260 VAC, single-phase,
47 to 440 Hz

28V DC Operation.....22 to 33 VDC, 13A

12V DC Operation.....11 to 18 VDC, 20A (BTC-70819-3 Only)

Charging Output Voltage..... Automatically selected for each battery type

Duty Cycle..... Continuous

Protective Features.....Resettable circuit breakers:

AC (3A)

28 VDC (13A)

12 VDC (20A)

Operating Temp. Range..... -4°F (-20°C) to +122°F (+50°C)

Storage Temp. Range..... -40°F (-40°C) to +158°F (+70°C)

Case Material Solid Polypropylene

Case Color..... Olive Drab #34088 per Fed-Std-595B

Shipment..... No restrictions

1-3. DECLARATION OF CONFORMITY



DECLARATION OF CONFORMITY EU Low Voltage Directive and EMC Directive

Bren-Tronics Inc., located at the Commack, NY, USA address shown above, certifies and declares under our sole responsibility that the following apparatus:

**Soldier Portable Charger Lite – SPC Lite
 BTC-70819 series of charger**

conforms with the essential requirements of European Community Council Directive 2004/108/EC, based on the following specifications applied:

EMISSIONS

Per EN 61000-6-3:2007: Emission Standard for Industrial Environments:
 EN 55022:1998 Class B, Conducted Emissions
 EN 55022:1998 Class B, Radiated Emissions
 IEC 61000-3-2:2000 Harmonics
 IEC 61000-3-3:1994 Flicker

IMMUNITY

Per EN 61000-6-1:2007: Immunity Standard for Industrial Environments:
 IEC 61000-4-2 2001 Electrostatic Discharge
 IEC 61000-4-3 Edition 3.1:2008-04 Radiated Immunity
 IEC 61000-4-4 2004 EFT/Burst, Power Leads
 IEC 61000-4-5 2005 Surge Immunity, Power Leads
 IEC 61000-4-6 Edition 3.0:2008-10 Conducted Immunity, Power Leads
 IEC 61000-4-11 2004 Voltage Dips and Interrupts


The given models also conform to European Community Council Directive 2006/95/EC, based on the following specifications applied:

SAFETY:


EN 60950-1:2006 Low Voltage Directive

The supporting technical documentation is maintained at the Commack, NY USA address shown above.

Certified and Declared as described above:


 Don Fagon
 Vice President, Quality
 BREN-TRONICS Inc.

28 Nov 2011
 Date


 Peter Burke
 Vice President, Engineering
 BREN-TRONICS Inc.

28 Nov 2011
 Date

1-4. ACCESSORIES

Table 1 shows the various batteries and appropriate adapter plates the SPC Lite supports at the time this document was written.

Table 2 shows various power cables and accessories.

Table 1 – Supported Batteries and Adapters

ADAPTER	ADAPTER NSN	BATTERY	TYPE	BATTERY NSN
BTA-70360	6130-01-555-7818	BB-4600	NiCd	6140-13-113-0171
BTA-70394	5940-01-427-9247	BB-503A/U	NiCd	6140-01-419-8193
BTA-70395 (1)	5940-01-427-9183	BB-326/U BB-516A/U	NiMH NiCd	6140-01-533-7674 6140-01-419-8191
BTA-70396	5940-01-427-9278	BB-2847A/U BB-2847/U	Li Ion Li Ion	6140-01-493-8092 6140-01-419-8194
BTA-70443	5940-01-467-8813	BB-2600/U BB-2600A/U	Li Ion Li Ion	6140-01-467-5853 6140-01-490-4311
BTA-70492A	5940-01-513-5662	BT-70477 BT-70492 BT-70492A	NiMH Li Ion Li Ion	6140-14-513-5369 6140-01-523-9840 6140-01-523-9840
BTA-70557	5940-01-467-5852	BB-557/U	NiCd	6140-01-071-5070
BTA-70574	5940-01-483-6772	ICOM SI	NiCd	---
BTA-70581	---	CSEL	Li Ion	6140-01-534-3856
BTA-70581A	5940-01-544-3476	CSEL	Li Ion	6140-01-534-3856
BTA-70582	---	ALI 124 ALI 142/BA-682A BA-682B BA-684A	NiCd Li Ion Li Ion Li Ion	--- 6140-14-328-2258 6140-14-561-1542 6140-14-529-5971
BTA-70582-1	---	ALI 124 ALI 142/BA-682A BA-682B BA-684A	NiCd Li Ion Li Ion Li Ion	--- 6140-14-328-2258 6140-14-561-1542 6140-14-529-5971
BTA-70589	6130-01-564-8116	ALI 116 ALI 124 ALI 142/BA-682A ALI 143/BA-687A ALI 243 BA-684A BA-685A BA-682B ALI 147 ALI 247	NiCd NiCd Li Ion Li Ion Li Ion Li Ion Li Ion Li Ion Li Ion Li Ion	--- --- 6140-14-328-2258 6140-14-530-0061 6140-14-553-4062 6140-14-529-5971 6140-14-529-5973 6140-14-561-1542 --- ---
BTA-70589A	---	ALI 142/BA-682A ALI 143/BA-687A ALI 243 BA-684A BA-685A BA-682B ALI 147 ALI 247	Li Ion Li Ion Li Ion Li Ion Li Ion Li Ion Li Ion Li Ion	6140-14-328-2258 6140-14-530-0061 6140-14-553-4062 6140-14-529-5971 6140-14-529-5973 6140-14-561-1542 --- ---
BTA-70598	---	BT-70598	Li Ion	---
BTA-70715	5940-01-573-9693	BT-70593 BT-70715	Li Ion Li Ion	--- ---

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BTA-70721	6130-01-573-4962	BT-70721	Li Ion	---
BTA-70732	---	BT-70732	Li Ion	---
BTA-70737	---	BT-70737	Li Ion	---
BTA-70740	---	BT-70740	Li Ion	---
BTA-70763	6130-01-555-7821	BN-2250	NiCd	6140-13-116-5482
BTA-70774	5940-01-573-9679	Motorola – NNTN7032A NTN9816A NTN9815A	Li Ion NiCd NiCd	--- --- ---
BTA-70807	5940-01-493-6750	BB-2800/U	Li Ion	6140-01-490-5372
BTA-70808	5940-01-493-6388	BB-2588/U BB-388/U	Li Ion NiMH	6140-01-493-7623 6140-01-490-4313
BTA-70810	5940-01-493-6751	THALES – MBITR	Li Ion	---
BTA-70811	5940-01-493-7622	AA CELLS	NiMH	---
BTA-70812	5940-01-492-7238	BB-2557/U BB-557/U	Li Ion NiCd	6140-01-490-5387 6140-01-071-5070
BTA-70817	---	D CELLS	NiMH	---
BTA-70834	5940-01-501-3312	BB-2590/U BT-70791A BT-70791E BB-390B/U BB-590/U BT-70876 SAFT – SAI-2590	Li Ion Li Ion Li Ion NiMH NiCd Li Ion Li Ion	6140-01-490-4316 --- --- 6140-01-490-4317 6140-01-063-3918 --- ---
BTA-70899	---	BB-2590/U BB-390B/U BT-70791A BT-70791E BT-70899A BT-70876 Saft – SAI-2590 Ultralife – UBI-2590	Li Ion NiMH Li Ion Li Ion Li Ion Li Ion Li Ion Li Ion	6140-01-490-4316 6140-01-490-4317 --- --- --- --- --- ---
BTA-70858	---	DRT 4453/4411	Li Ion	---
BTA-70406-3	---	BA-386	NiCd	---
BTA-70851 (1)	---	Racal 931	NiCd	---
BTA-70852	---	PTR-349	NiCd	---
BTA-70853	---	Loral – RT1606	NiCd	---
BTA-70872	---	BB-NM10	NiCd	---
BTA-70868	---	LI-145 LI-80	Li Ion Li Ion	--- ---
BTA-70706-1	---	BB-2598	Li Ion	---
BTA-70406	---	BB-586	NiCd	6140-01-084-1460
BTA-70661	---	BT-70661	Li Ion	---
BTA-70685	---	ALKABAT	NiCd	---
BTA-70838-7	---	BT-70838 IdZ BT-70838-2/3 IdZ	Li Ion Li Ion	--- ---

NOTES:

- 1) The BB-516A, BB-326, and RACAL 931 can only charge with AC power on the BTC-70819. There is no limitation on the BTC-70819-3
- 2) The Adapter BTA-70480/3 is not compatible with this charger.
- 3) This list was complete at the date of publication. Additional adapters may be available, but may require updated software.

Table 2 – Power Cables and Accessories

DESCRIPTION	BTI P/N	GENERAL P/N	NSN
AC Power Cord US	591609	-----	-----
AC Power Cord EU	590233-3	-----	-----
AC Power Cord UK	590233-4	-----	-----
DC Power Cable w/rings	BTA-70844-24	-----	-----
DC Power Cable w/allig. clips	BTA-70844-24-AL	-----	-----
Gabriel DC Power Cable	BTA-70819-24	-----	-----
DC Hummer Cable	BTA-70835	J-6362A/U	5940-01-501-6714
DC Splitter Cable	BTA-70816	CX-13560/G	5995-01-505-7883
BB-390/2590 Self Discharger	BTF-70791	SDD2	6130-01-490-4310



Figure 1-4.1: BTA-70844-24



Figure 1-4.2: BTA-70835



Figure 1-4.3: BTA-70816 (for use with BTA-70835)



Figure 1-4.4: BTF-70791

1-5. CHARGE CYCLE DESCRIPTION

Each of type the battery that are capable of being charged by the Charger is connected to the charger via their respective battery adapter (plate or cable). Each adapter can charge two batteries simultaneously. The appropriate battery adapter is installed on the control panel and serves as the electrical interface between the batteries being charged and the charger circuits. The battery charger control circuits constantly monitor the following battery conditions during the charge cycle, as appropriate, to ensure that the battery is properly being charged:

- a. Temperature (T)
- b. Voltage (V)
- c. Current (I)
- d. Time (t)
- e. Voltage change (ΔV)
- f. Temperature rate of change ($\Delta T/\Delta t$)

The charger operation during a typical charge sequence is automatic and the battery charge status is displayed to the user by the panel LED indicators as follows:

- a. **Detection** - The charger tries to detect a battery in an adapter. The CHARGE LED (amber) blinks slowly during this process.
- b. **Pre-charge** – The charger brings the battery voltage up to a safe level before the rapid charge process begins. This step may take several minutes for a very discharged battery. The CHARGE LED (amber) blinks rapidly during this process.
- c. **Fast Charge** – A timed fast charge cycle brings the battery to approximately 90% of full charge capacity. The CHARGE LED (amber) is lit solid during this process.
- d. **Ready** – The fast charge cycle is complete. The Battery may be removed and used at this time. The READY LED (green) is lit steadily at this time.
- e. **Trickle / Top-off** – When fast charge is complete, the charger will top off of the battery to 100%. For Lithium Ion and Lithium Polymer batteries the top-off cycle will stop after the battery is 100% charged. For all other types, the Trickle / Top-off cycle is repeated indefinitely to keep the battery at 100% charge. Leaving the battery on the charger will not harm the battery. The battery may be removed and used at this time. The READY LED (green) blinks during this process.

NOTE

The Battery may be removed and used at anytime during the charge cycle without damage to the charger or battery. If present, the state-of-charge indicator (SOC) will display the battery condition.

NOTE

After removing a battery from the charger, wait for the corresponding battery status LED's to turn off before installing a new battery.

1-6. UPDATING CHARGER SOFTWARE

The software in the charger is field upgradeable. By loading new software into the charger, it is possible to alter its operation and add or change the charging profiles for the batteries. Loading new software into the charger is accomplished via the use of a standard RS232 interface of a personal computer (PC) running Windows 95™ or higher. Utilizing special software running on the PC in conjunction with the boot program resident within the charger, a two-way communication link is established and the revised operational parameters and battery charge profiles can be loaded into the charger. Specific instructions for upgrading the Charger software are provided with the software upgrades.

SECTION 2 OPERATING PROCEDURES

2-1. PANEL CONTROLS AND INDICATORS

Battery charger panel components are described below and shown in Figure 2-1.1 and 2-1.2

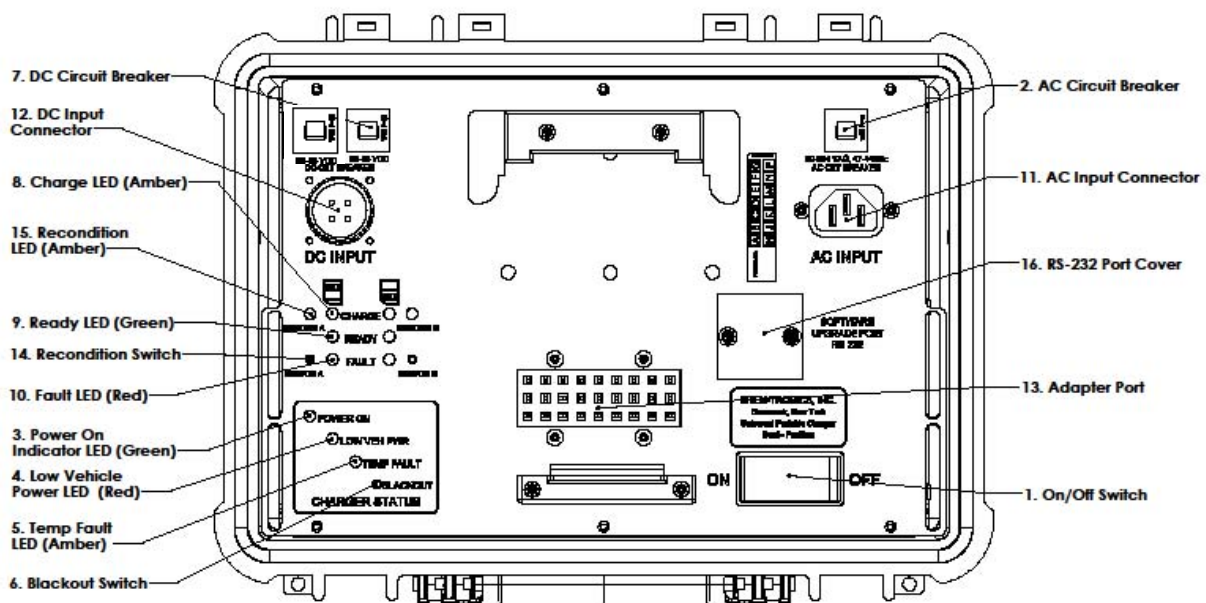


FIGURE 2-1.1

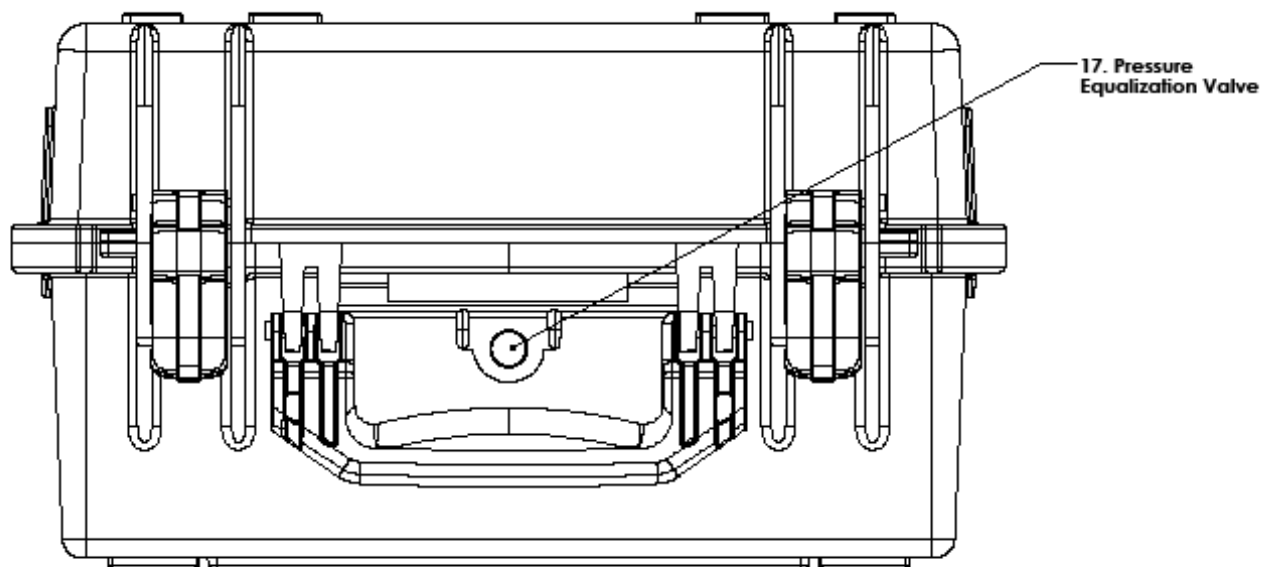


FIGURE 2-1.2

Item	Function
1. On/Off Switch.....	Turns battery charger on or off.
2. AC Circuit Breaker.....	Turns power to the charger off in an overload condition. Remove the overload condition and push to reset.
3. Power On Indicator LED (Green).....	The Power On Indicator LED lights when the charger has sufficient power from either AC or DC.
4. Low Vehicle Power LED (Red).....	The Low Vehicle power indicator lights when external DC power is too low to charge batteries. The charger will stop charging batteries until sufficient power is available from the DC source.
5. Temp Fault LED (Amber).....	The Temperature Fault indicator lights when charger temperature is too high (50°C) or too low (-20°C). The charger will stop charging batteries.
6. Blackout Switch.....	Enables / Disables Blackout Mode. Pressing it once turns off all panel LEDs. Pressing it again turns on all panel LEDs. Holding down the button during turn-on keeps the LED's off during the Lamp Test.
7. DC Circuit Breakers.....	Turns power to the charger off in an overload condition. Remove the overload condition and push to reset.
8. Charge LED (Amber).....	The Amber LED lights steady while the associated battery is being fast-charged. A slow blinking indication means the charger is trying to find a battery at the select position. A fast blinking indication means the charger is preconditioning the battery before charging it.
9. Ready LED (Green).....	The Green LED indicates the associated battery is fully charged and ready to be removed for use. Steady light means the battery has completed fast charge. A blinking indication means the battery is being topped off.

10. Fault LED (Red)..... If the Red LED lights steadily, the associated battery, or adapter plate is defective or will not accept charge. A blinking indication means the battery's temperature sensor or communication connection is not making contact with the adapter.

11. AC Input Connector..... Input connection for AC cable assembly.

12. DC Input Connector..... Input connection for DC cable assembly.

13. Adapter Port..... Provides interface connection for battery adapters.

14. Recondition Switch..... Activates NiCd revitalization or Li-Ion de-storage.

15. Recondition LED (Amber)..... Lights amber during revitalization / de-storage process.

16. RS-232 Port Cover..... Remove this cover to upgrade the charger's software. Otherwise leave the cover in place.

17. Pressure Equalization Valve..... This valve must be loosen before the cover is opened and latches unfastened.

2-2. PRELIMINARY SETUP PROCEDURES

- Step 1. Place the unit on the work surface. Loosen the **Pressure Equalization Valve** (Fig 2.1-2 #17) by unscrewing the knob two full turns in a counterclockwise direction. Unfasten latches and open cover.
- Step 2. Set the **On/Off Switch** (Fig 2.1-1 #1) to OFF position.
- Step 3. The cover may be removed by removing both hinge pins with pliers.
- Step 4. For AC operation: Connect the AC power cord from **AC Input Connector** (Fig 2.1-1 #11) to an AC power source and set the **On/Off Switch** (Fig 2.1-1 #1) to ON position. Observe that the **Power On Indicator LED** (Fig 2.1-1 #3) lights, the fan operates, and all the indicator LEDs blink in order (amber, then green, then red) briefly when power is first applied.
- Step 5. For DC operation: Connect the DC cable from the **DC Input Connector** (Fig 2.1-1 #12) to a DC power source such as the NATO slave receptacle found in most military vehicles. Set the **On/Off Switch** (Fig 2.1-1 #1) to the ON position. Observe that the **Power On Indicator LED** (Fig 2.1-1 #3) lights, the fan operates, and all the status indicator LEDs (Fig 2.1-1 #8, #9, and #10) blink in order (amber, green, then red) briefly when power is first applied.
- Note: If both Multiple Power Sources are connected:
- For the BTC-70819-3 if AC and DC are connected the charger will use AC power. If 12 and 28 VDC power are connected the charger will use 28VDC.
 - For the BTC-70819 if AC and DC are connected the charger will use DC power.
- Step 6. Observe that only the **Power On Indicator LED** (Fig 2.1-1 #3) is lit.
- Step 7. Install the appropriate battery adapter into the **Adapter Port** (Fig 2.1-1 #13) for battery type to be charged. Install the adapter by first placing the back of the adapter into the rear retainer. Note the alignment of the pins. The connector can only be plug in one way, do not force it. Be sure that battery adapter is fully seated on the panel. For Cable adapters, line up the pins to the **Adapter Port** (Fig 2.1-1 #13). 18 Pin Connectors will plug in toward the right side on the charger, do not force the connector.
- Step 8. Observe, after a short delay, that the two amber **Charge LEDs** (Fig 2.1-1 #8) will blink for several seconds. This shows battery charger circuits are initialized to the selected battery adapter and are ready to accept a battery (or batteries) for charging. If all of the status indicator LEDs (Fig 2.1-1 #8, #9, and #10) for a channel light at the same time, the adapter could not be recognized or the adapter is damaged, insure it is seated correctly. If running on DC, verify that the battery is supported by DC charging (ex: the BB516 is not). Verify that the charger software revision supports the adapter and battery.

2-3. CHARGING BATTERIES

- Step 1. With the appropriate battery adapter installed, insert the first battery to be charged into the channel "A" battery location. Insure the battery is fully seated in the adapter. Observe that the amber **Charge LED** (Fig 2.1-1 #8) for the corresponding location is lit or blinking rapidly. The **Charge LED** (Fig 2.1-1 #8) for the "B" battery location will continue to blink if the channel "B" battery location is left empty. If the red **Fault LED** (Fig 2.1-1 #10) is lit, the battery or adapter may be defective, check by removing the battery and the adapter. Then reinstall the adapter and battery. If the **Fault LED** (Fig 2.1-1 #10) still lights, go to the Troubleshooting section (section 2.7, 2.8, and 3-5) of this Guide.
- Step 2. Install the next battery into the Channel B battery location.
- Step 3. After fast charging is complete, the amber **Charge LED** (Fig 2.1-1 #8) will turn off and the green **Ready LED** (Fig 2.1-1 #9) will be lit. The charger will then top-off the batteries that have successfully completed fast charge. The battery is slow-charged to full capacity, as indicated by the blinking green **Ready LED** (Fig 2.1-1 #9). For Lithium-ion batteries, the cycle will stop after the battery is 100% charged. For other types the cycle is repeated indefinitely to keep the battery at 100% charge. As long as the green **Ready LED** (Fig 2.1-1 #9) is lit (blinking or solid) the battery may be removed and returned to service and another battery may be installed for charging.

NOTE

The BB-390A/U and the BB-390B/U batteries include two independent 12-volt sections. A relay "clicking" may be heard from the battery adapter when battery sections are switched. Other types of adapters may also contain relays and click intermittently during normal operation.

NOTE

Battery charger power may be left ON while batteries and/or adapters are removed or replaced. Batteries may be left on the charger for long periods of time without damaging the batteries or the charger. This is true whether if the charger is on or off.

2-4. BATTERY REVITALIZATION AND DE-STORAGE

The procedures outlined below describe the means of invoking the Revitalization and De-storage functions of the charger as well as the sequence of operations the charger will execute to perform the commanded tasks.

NiCd and Ni-Mh Batteries are revitalized. Li-Ion batteries are de-stored.

The charger will decide what to do based on the batteries' chemistry.

a. NiCad and Ni-Mh Revitalization

Due to the increased power dissipation from discharging the batteries, this function will not operate above 45° C. The following procedure is used to invoke the Revitalization process:

1. Power up the charger.
2. Plug in adapter.
3. Once the adapter is recognized (the two amber **Charge LED** (Fig 2.1-1 #8) blink) press the **Recondition Switch** (Fig 2.1-1 #14) for the A or B channel; the amber **Recondition LED** (Fig 2.1-1 #15) will light for the corresponding channel.
4. Plug the battery into the activated channel.
5. Revitalization will commence upon recognition of the battery.

Autonomously, the charger will perform the following revitalization sequence:

1. Check environment temperature, if the temperature is above 45° C it will not proceed.
2. Discharge the battery without a capacity measurement.
3. Fully charge the battery.
4. Discharge the battery and calculate the capacity.
5. Fully charge the battery.
6. If the capacity in step 4 is greater than or equal to 80% of the battery specification, the green **Ready LED** (Fig 2.1-1 #9) will light, and the **Recondition LED** (Fig 2.1-1 #15) will remain lit and the process is complete.
7. If the capacity in step 4 is less than 80%, steps 4 and 5 will repeat a second time. If after the second cycle the capacity is less than 80% of the battery specification, the red **Fault LED** (Fig 2.1-1 #10) will light. The **Recondition LED** (Fig 2.1-1 #15) remains lit and the process is complete.

b. Li-Ion De-storage

Due to the increased power dissipation from discharging the batteries, this function will not operate above 45° C. The following procedure is used to invoke the de-storage process:

1. Power up the charger.
2. Plug in adapter.
3. Once the adapter is recognized (the two amber **Charge LED** (Fig 2.1-1 #8) blink) press the **Recondition Switch** (Fig 2.1-1 #14) for the A or B channel;

the amber **Recondition LED** (Fig 2.1-1 #15) will light for the corresponding channel.

4. Plug the battery into the activated channel.

5. De-storage will commence upon recognition of the battery. Autonomously, the Charger will perform the following de-storage sequence:

- a. Check environmental temperature, if the temperature is above 45° C it will not proceed.
- b. Fully discharge the battery.
- c. Fully charge the battery while measuring its capacity.
- d. Discharge the battery to 45% of its measured capacity.
- e. The green **Ready LED** (Fig 2.1-1 #9) will light, the **Recondition LED** (Fig 2.1-1 #15) remains lit and the process is complete.

2-5. BLACKOUT

Pressing the **Blackout Switch** (Fig 2.1-1 #6) will turn off all the LEDs. Pressing the switch again will turn the LEDs back on. The charger will remember the correct state for all batteries. The blackout mode is disabled each time the charger is turned on.

Holding the **Blackout Switch** (Fig 2.1-1 #6) down while turning the charger power switch on will suppress the startup LED Test.

2-6. BATTERY CHARGER LABELS

Shown below are the instructions contained on the "SHORT FORM - OPERATING PROCEDURE" label, attached inside the charger cover.

LED INDICATIONS FOR EACH BATTERY

S = STEADY, F = FLASHING

LIGHT INDICATIONS FOR EACH BATTERY						
AMBER	GREEN	RED	RECON	DEFINITION	REMARKS	
F	F	F	F	CHARGER START UP	LIGHTS SCROLL MOMENTARILY	
				NO ADAPTER PRESENT	ADAPTERS MUST BE INSTALLED	
F				NO BATTERY PRESENT	AWAITING BATTERY TO CHARGE (SLOW BLINKING)	
F				CHARGE PREQUALIFICATION	PRE-CHARGE CHECK (RAPID BLINKING)	
S				FAST CHARGE IN PROCESS	TWO BATTERIES CAN CHARGE SIMULTANEOUSLY	
	F			TRICKLE CHARGE IN PROCESS	BATTERY IS READY TO USE; REMOVE WHEN READY	
	S			CHARGE IS COMPLETE	BATTERY IS READY TO USE; REMOVE WHEN READY	
		S		FAULTY BATTERY; DO NOT USE	CONSULT STANDARD OPERATING PROCEDURE	
		F		CONTACT PINS ARE DIRTY OR DAMAGED	CLEAN BATTERY CONTACTS; CHECK ADAPTER PINS	
S			S	RECONDITION / DESTORE CYCLE IN PROCESS	RECONDITION (Ni); DESTORE (Li)	
			F	EXCESSIVE TEMPERATURE FOR RECONDITIONING	RELOCATE TO COOLER ENVIRONMENT	
S	S	S		INCOMPATIBLE BATTERY OR ADAPTER	UNSUPPORTED OR SOFTWARE UPDATE REQUIRED	

S=Steady F= Flashing				LIGHT INDICATIONS FOR EACH BATTERY	
AMBER	GREEN	RED	RECON	DEFINITION	REMARKS
F	F	F	F	CHARGER START UP	LIGHTS SCROLL MOMENTARILY
				NO ADAPTER PRESENT	ADAPTERS MUST BE INSTALLED
F				NO BATTERY PRESENT	AWAITING BATTERY TO CHARGE (SLOW BLINKING)
F				CHARGE PREQUALIFICATION	PRE-CHARGE CHECK (RAPID BLINKING)
S				FAST CHARGE IN PROCESS	TWO BATTERIES CAN CHARGE SIMULTANEOUSLY
	F			TRICKLE CHARGE IN PROCESS	BATTERY IS READY TO USE; REMOVE WHEN READY
	S			CHARGE IS COMPLETE	BATTERY IS READY TO USE; REMOVE WHEN READY
		S		FAULTY BATTERY: DO NOT USE	CONSULT STANDARD OPERATING PROCEDURE
		F		CONTACT PINS ARE DIRTY OR DAMAGED	CLEAN BATTERY CONTACTS; CHECK ADAPTER PINS
S			S	RECONDITION/DESTORE CYCLE IN PROCESS	RECONDITION (Ni); DESTORE (Li)
S		S		RECONDITION/DESTORE FAILED	CONSULT STANDARD OPERATING PROCEDURE
			F	EXCESSIVE TEMPERATURE FOR RECONDITIONING	RELOCATE TO COOLER ENVIRONMENT
S	S	S		INCOMPATIBLE BATTERY OR ADAPTER.	UNSUPPORTED OR SOFTWARE UPDATE REQUIRED
S	S	S		INSUFFICIENT DC VOLTAGE TO CHARGE THIS BATTERY TYPE	USE AN AC POWERSOURCE

2-7. SOLID RED FAULT LED TROUBLESHOOTING

1. Remove the battery and inspect all the contacts, clean if necessary. Note the battery location.
2. Reinstall at the same location for another charge cycle.
3. If the **Fault LED** (Fig 2.1-1 #10) is lit again at the same location remove battery and do the following:
 - a. If the battery is NiCad or Ni-Mh and was in storage, try to revitalize the battery (see section 2.4).
 - b. Check battery: If the battery is older than 3 yrs, it may be ready for disposal.
 - c. Check the warranty instructions on the battery. If the warranty is expired or no instructions were given on the battery, dispose of the battery.
 - d. Note success/failure of the future battery charges at this battery location. If the **Fault LED** (Fig 2.1-1 #10) is lit again, the adapter may need to be changed.

2-8. FLASHING RED FAULT LED TROUBLESHOOTING

1. This condition is telling you that some of the battery contacts are not connecting to the charger.
 - a. For BB-390 and other batteries with thermistors, the thermal contacts may not be making proper contact with the adapter.
 - b. For Falcon, CSEL, MBITR, and other batteries the communication pin(s) may not be making proper contact with the adapter.
 - c. To minimize this issue; before you first start using the charger, ensure the battery contacts are clean and the adapter contact pins are in place and retain their spring action: Check by pushing down the pins and releasing.
2. You can still charge batteries with thermal / communication pins missing or damaged, it will take longer, and may not fully charge in one cycle.
3. If the flashing "red" condition continues, note the adapter battery location and battery affected.
 - a. Remove the battery and clean the thermal contacts.
 - b. Check adapters again. If problem continues at this location, the adapter may need to be changed.

2-9. OPERATION IN EXTREME ENVIRONMENTAL CONDITIONS

Observe these precautions when the charger is operated in areas where severe climatic conditions may exist:

a. Operation in Arctic Climates. The battery charger is designed to function in temperature extremes as low as -4°F (-20°C). However, when operating in arctic climates, the following precautions should be observed:

- (1) Handle the equipment carefully. The plastic components may become more brittle.
- (2) Keep the equipment clean and dry.
- (3) Prevent ice from forming on the charger and the batteries. Ice formations may prevent proper electrical connections. Melting ice may allow water to enter the charger.

When not in use, be sure the cover is fully latched and the **Pressure Equalization Valve** (Fig 2.1-2 #17) is fully closed (tighten by turning the knob in clockwise direction).

b. Operation in Desert Climates. The charger is designed to operate in temperature extremes as high as 122°F (50°C) and the dryness associated with a desert environment. However, the sand and dust accumulation on and in the charger may cause poor electrical connections and reduce the cooling effectiveness of the charger. Follow proper cleaning and maintenance guidelines (Section 3-2) to assure proper operation. When not in use, be sure the cover is fully latched and the **Pressure Equalization Valve** (Fig 2.1-2 #17) is fully closed (tighten by turning the knob in clockwise direction).

c. Operation in Salt Spray. Keep the equipment clean and dry at all times and immediately wipe salt spray from all the exposed surfaces on the charger and cables and connectors. When not in use, be sure the cover is fully latched and the **Pressure Equalization Valve** (Fig 2.1-2 #17) is fully closed (tighten by turning the knob in clockwise direction).

d. Operation in Rain. Keep the equipment dry at all times. Water penetration in the charger, cables and the connectors will cause equipment failure. When not in use, be sure the cover is fully latched and the **Pressure Equalization Valve** (Fig 2.1-2 #17) is fully closed (tighten by turning the knob in clockwise direction).

NOTE

Battery charge acceptance varies with ambient temperature conditions. At temperatures lower than 32°F (0°C) or higher than 104°F (40°C) it may be necessary to initiate two complete charging cycles to achieve full charge on the battery.

2-10. PREPARATION FOR MOVEMENT

- a. Set the **On/Off Switch** (Fig 2.1-1 #1) to OFF position.
- b. Remove any installed batteries.
- c. Disconnect the AC power cable.
- d. Disconnect the DC power cable.
- e. Unplug cable type adapters. (Plate type adapter may be left installed.)
- f. Replace the charger cover if it was removed.
- g. Close the charger cover and secure latches.
- h. Close the **Pressure Equalization Valve** (Fig 2.1-2 #17) by turning clockwise until tight.

2-11. BATTERY STATE-OF-CHARGE DISPLAYS

Batteries equipped with state-of-charge (SOC) displays indicate battery charge status on a five-segment LCD bar graph readout. The number of LCD segments activated corresponds to the battery's state-of-charge as follows:

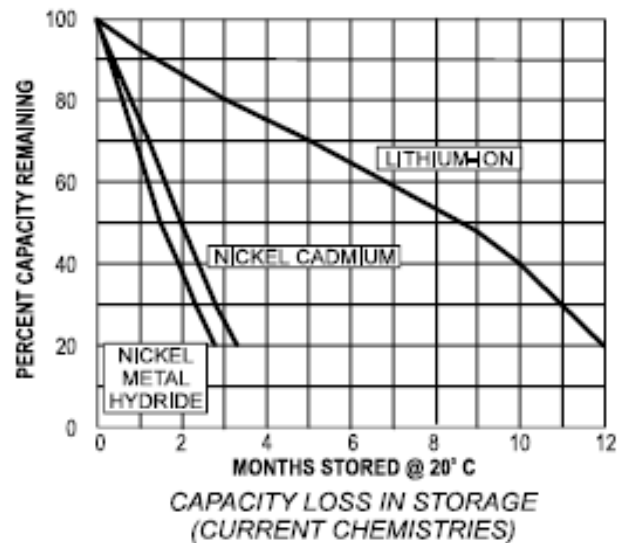
<u>Segments</u>	<u>State-of-Charge</u>
0	0% (fully discharged)
1	1 to 20%
2	21 to 40%
3	41 to 60%
4	61 to 80%
5	81 to 100% (fully charged)

NOTE

The BB-390A/U, BB-390B/U, BB-2590/U, BB-2557/U and other batteries have two SOC indicators. Each SOC indicator provides state-of-charge indication for each of the two 12V sections. Both SOC's must display 100% for the battery to be fully charged.

2-12. BATTERY CAPACITY RETENTION

As shown in the adjoining graph, fully charged batteries that are stored, lose a portion of their charge due to battery chemistry. This is normal and should not be interpreted as battery failure. Storage at higher temperatures increases capacity losses, while storage at lower temperature decreases capacity losses. The graph shows that Nickel based batteries like the BB-390 lose over 30% charge/month (1% /day) on the shelf waiting to be used. The BB-2590 (a Li-Ion based battery) loses less than 10% a month on the shelf.



2-13. BATTERY STORAGE

Nickel based batteries may require 1 or more charge / discharge cycles after a long period of storage. They may not charge fully on the first charge cycle. Repeat the charge if necessary using the Revitalizations feature (see section 2.4). If the battery does not fully charge after 3 cycles it may no longer be serviceable.

Lithium based batteries must be charged yearly if held in storage. Long term storage of fully discharged Lithium based batteries can permanently damage the battery. They do not require charge / discharge cycling after storage. If the battery does not charge (No SOC Bars), place it back on the charger for one additional charge cycle. Do not discharge it first. If the battery does not fully charge it may no longer be serviceable.

SECTION 3

OPERATOR MAINTENANCE INSTRUCTIONS

3-1. INTRODUCTION

Periodic maintenance, inspection and cleaning will help insure the Charger is kept at full readiness.

3-2. CLEANING

1. Brush loose dirt and dust from the charger. Low-pressure air may be used to remove heavy dust from the case, connectors and power switches. Avoid blowing dust into the unit. Low-pressure air may be blown into the left and right air vents at the edge of the control panel to help remove internal dust.
2. Wipe surfaces with a damp (not wet) rag. Non-solvent cleaners may be used (Windex™, Fantastik™, and Formula 409™). Do not spray or drip water or cleaners onto the panel or into the connectors.
3. The flush mounted adapter connectors may be cleaned with electronic grade spray cleaner. Allow the cleaner to dry before installing the adapters and/or applying power to the charger.
4. The connections on the adapters may be cleaned with electronic grade spray cleaner or isopropyl alcohol. Insure the adapters are dry before using them.

3-3. INSPECTION

1. Inspect case for cracks and other damage.
2. Insure the lid gasket is in place.
3. Insure the Hinge Pins are fully inserted (some models of charger also include cover stays).
4. Insure the lid closes and can be properly latched.
5. Insure all Screws are in place and are not loose.
6. Inspect the panel and connectors for damage.
7. Inspect all adapters for excessive wear and damage.
 - a. Inspect charger connector for bent or corroded pins.
 - b. Inspect battery connector pins for damage or corrosion.
 - c. Insure all spring pins are not bent and move freely.
 - d. Note that spring pins can be removed and replaced.
8. Inspect power cords for damage.
9. Insure power switches move freely.
10. Insure the **Pressure Equalization Valve** (Fig 2.1-2 #17) can be tightened.

3-4. BASIC FUNCTIONAL TEST

1. Set the **On/Off Switch** (Fig 2.1-1 #1) to OFF position, and remove any adapter installed.
2. Connect the charger to AC power.
3. Set the **On/Off Switch** (Fig 2.1-1 #1) to ON position.
4. The front panel LED's should light in sequence. Amber, then Green, then Red. Insure all LED's light.
5. Insure the **Power On Indicator LED** (Fig 2.1-1 #3) is lit and that all other indicator LEDs are off.
6. Place an adapter into the **Adapter Port** (Fig 2.1-1 #13).
7. Verify that the two **Charge LEDs** (Fig 2.1-1 #8) start to blink.
8. Press each of the **Recondition Switch** (Fig 2.1-1 #14) several times. Verify the **Recondition LED** (Fig 2.1-1 #15) alternates on then off with each press.
9. Place a battery on Channel A. Insure that the **Charge LEDs** (Fig 2.1-1 #8) blinks rapidly then turns on solid.
10. Repeat Step 9 for Channel B.
11. Set the **On/Off Switch (Fig 2.1-1 #1)** to OFF position and disconnect AC Power.
12. Connect the charger to 28 Volts DC power.
13. Set the **On/Off Switch** (Fig 2.1-1 #1) to ON position.
14. The front panel LED's light in sequence. Amber, then Green, then Red. Insure all LED's light.
15. Press the **Blackout Switch** (Fig 2.1-1 #6). Verify that all panel LEDs turn off.
16. Press the **Blackout Switch** (Fig 2.1-1 #6) again. Verify all panel LEDs resume normal operation.
17. For the BTC-70819-3 Only
 - a. Set the **On/Off Switch** (Fig 2.1-1 #1) to OFF position and disconnect the 28 Volts DC Power.
 - b. Connect the charger to 12 Volts DC power.
 - c. Set the **On/Off Switch** (Fig 2.1-1 #1) to ON position.
 - d. The front panel LED's light in sequence. Amber, then Green, then Red. Insure all LED's light.
18. End of test.

3-5. SIMPLIFIED OPERATOR TROUBLESHOOTING PROCEDURES

Item	MALFUNCTION	POSSIBLE CORRECTIVE ACTION
1	POWER ON LED is not lit during AC operation.	1) Inspect Power Cord and AC Switch. 2) Reset AC Circuit Breaker. Note: The Circuit breaker is tripped if the white band is visible.
2	POWER ON LED is not lit during DC operation.	1) Inspect Power Cord and DC Switch. 2) Reset DC Circuit Breaker. Note: The Circuit breaker is tripped if the white band is visible.
3	All LED's light and stay lit after the charger is turned on.	1) The unit has lost its program. a. Re-program the unit. b. The unit requires repair. Call or e-mail Bren-Tronics. Info on warranty tag.
4	The LED's do not blink in sequence at start up.	1) Verify the Temp Fault and Veh Power indicators are not lit. 2) The unit requires repair. Call or e-mail Bren-Tronics. Info on warranty tag.
5	TEMP FAULT LED is lit.	1) The Charger is too hot or too cold. Move the charger to a more suitable environment. 2) The air vents at the left and right side of the charger are blocked. 3) Operating the chargers edge to edge can cause overheating of the charger on the right. 4) One of the internal fans has failed. The unit requires repair. Call or e-mail Bren-Tronics. Info on warranty tag.
6	LOW VEH PWR LED is lit.	1) If the unit is running from DC power verify the voltage is correct. 2) If the unit is running from AC power the unit requires repair.
7	All 3 LED's (CHARGE, READY, FAULT) are lit.	1) Poor connection between Adapter and Charger. Inspect, clean and reseal Adapter. 2) Defective Adapter, use a different Adapter. 3) The charger does not support the Adapter. Update the charger software See para 3-7.
8	FAULT LED is lit.	1) Check battery: older than 3 yrs? Maybe ready for disposal. Discharge & recharge or Revitalize, IF RED AGAIN? 2) Check warranty instructions on battery. If not covered or no instructions, dispose of. 3) Note success/failure of future battery charges at this Port. More "RED" lights? Change adapter.

MAINTENANCE

9	FAULT LED is blinking.	<ol style="list-style-type: none"> 1) This condition is telling you the thermal contacts on the BB-390 or communication contacts on other batteries are not making contact with the charger. To minimize this issue before you first start using the charger: Ensure.... <ol style="list-style-type: none"> a) Two Thermal contacts are in place in each battery position on the BB-390, or all contacts on other batteries. b) Adapter contact pins are in place and retain their spring action: Check by pushing down the pins and releasing. The pins should spring up. If not or are missing, you may be able to replace pins/adapter. c) You can still charge Batteries with contact pins missing or damaged, it will just take longer. The FAULT LED will continue to blink. 2) If flashing "red" condition after this check, Mark location of condition and battery affected. 3) You can pull batteries and clean thermal contacts on the battery. 4) Check adapters again. Mark for future review. If a problem continues at this location, change the Adapter.
10	Charger never tries to charge a battery.	<ol style="list-style-type: none"> 1) Possible poor connection, inspect and clean battery and adapter contacts. 2) Defective adapter, use a different adapter. 3) Defective battery, replace the battery.
11	Port LED goes to Amber (CHARGE), but never turns Red (FAULT) or Green (READY), instead it turns off.	<ol style="list-style-type: none"> 1) Poor connection, inspect and clean battery and adapter contact. 2) Defective adapter, use a different adapter. 3) Defective battery, replace the battery.
12	Recondition LED will not turn on when Recondition Switch is pressed or turns off when the battery is "Found".	<ol style="list-style-type: none"> 1) The Battery or Adapter does not support Reconditioning or Destorage.
13	Recondition LED is blinking and the Port's Status LEDs are all off.	<ol style="list-style-type: none"> 1) The charger is too hot (over 45°C) to discharge the battery. Move the charger to a cooler area. 2) The air vents at the left and right side of the charger are blocked. 3) Operating the chargers edge to edge can cause overheating of the charger on the right. 4) One of the internal fans has failed. The unit requires repair. Call or e-mail Bren-Tronics. Info on warranty tag.
14	Fault LED stays lit after battery is removed.	<ol style="list-style-type: none"> 1) Battery is defective. Cycle power to clear fault.

3-6. WARRANTY / REPAIR INFORMATION

If the Charger or Adapters fail to function they must be returned to Bren-Tronics for repair. The warranty label gives the expiration date on each unit. Contact Bren-Tronics for a Return Material Authorization (RMA) number before returning any hardware to Bren-Tronics. The part numbers, serial numbers and failure descriptions must be included for Bren-Tronics to issue an RMA number. Chargers that have been damaged by abuse or that are no longer under warranty may be returned for a repair quotation. There are no user repairable parts in the charger. Opening the charger will void the warranty.

For return authorization call (631) 499-5155 or email sales@bren-tronics.com

3-7. UPGRADE / UPDATE INFORMATION

The Charger Operation Software is field upgradeable. Updates usually add support for additional battery adapters. They may also include enhanced battery charging methods. The upgrade can be done with a PC running Windows 95 or newer in about 15 minutes. All that is required is a computer serial cable and a screwdriver. Information about new adapters and software can be found at:

<http://www.bren-tronics.com>

Call (631) 499-5155

or

Email sales@bren-tronics.com